United States Patent [19]

Shah et al.

[11] **4,350,238**

[45] **Sep. 21, 1982**

[54] **DATA ACQUISITION UNIT**

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[73] Assignee: **UMC Industries, Inc.,** Stamford, Conn.

[21] Appl. No.: **137,436**

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[51] **Int. Cl.**[3] **G07F 9/08**

[52] **U.S. Cl.** .... **194/1 N;** 221/7; 235/92 CN; 364/479

[58] **Field of Search** .... 194/1 L, 1 M, 1 N; 221/2, 7, 129; 364/403, 404, 406, 478, 479; 235/92 AC, 92 CN

[56] **References Cited**

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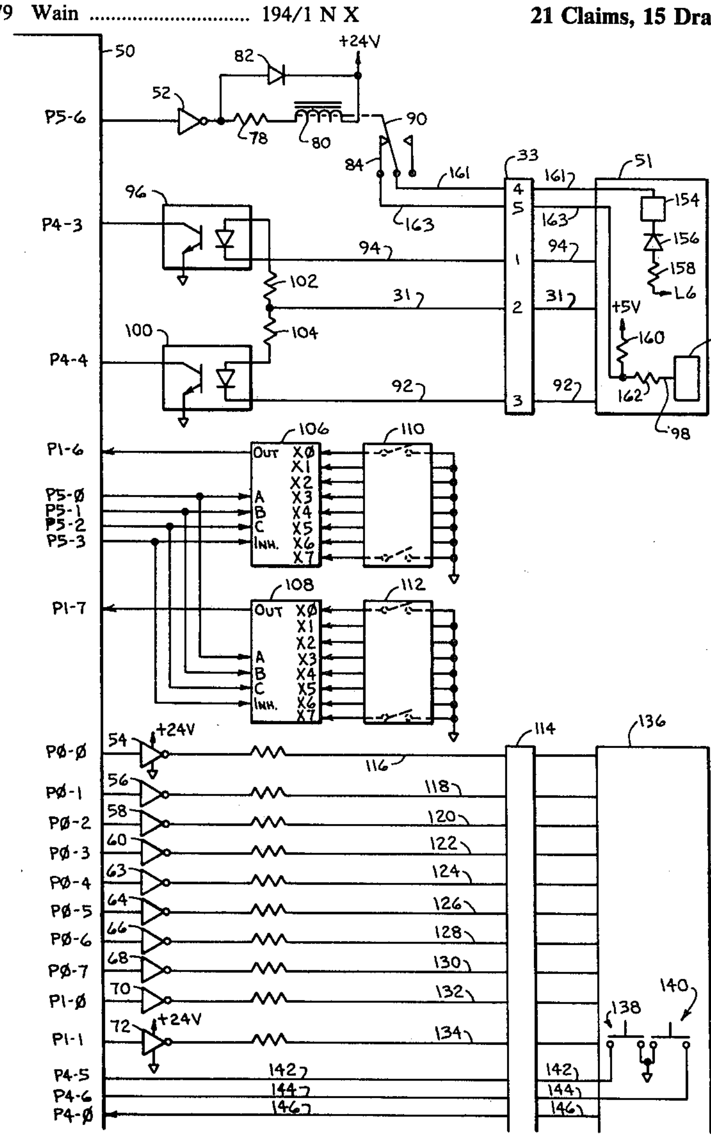
Primary Examiner—Robert J. Spar
Assistant Examiner—Edward M. Wacyra
Attorney, Agent, or Firm—Senniger, Powers, Leavitt and Roedel

[57] **ABSTRACT**

A data acquisition unit accepts serial bit streams from a control device for a vending machine, and it records the data represented by those serial bit streams. The data in one of those serial bit streams will include the number of vends of each product corresponding to the various selection switches of the vending machine, and the data in the other of those serial bit streams will include the price data. The data acquisition unit will store the price data in a non-resettable location and also in a resettable location. A readout can be actuated to effect the displaying of the selection line number and of the corresponding settable and non-resettable price data.

21 Claims, 15 Drawing Figures



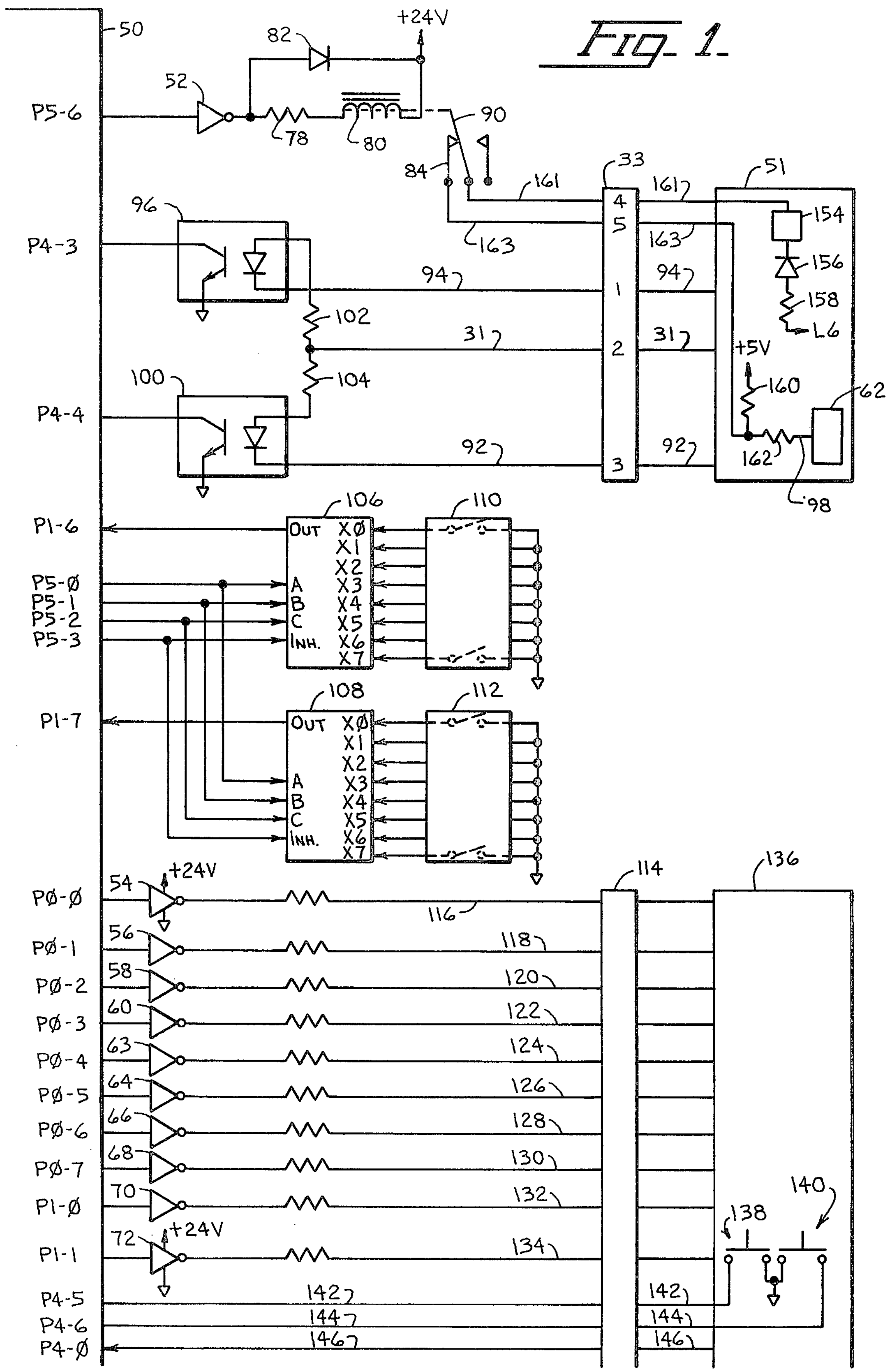


Fig. 1
+24V
50
82
52
90
P5-6
78
80
84
33
51
161
163
4
5
154
156
158
L6
96
P4-3
94
1
102
31
2
+5V
100
104
160
62
P4-4
92
3
162
98
106
110
P1-6
OUT
X0
X1
X2
X3
X4
X5
X6
X7
A
B
C
INH.
P5-0
P5-1
P5-2
P5-3
108
112
P1-7
54
114
136
P0-0
116
56
P0-1
118
58
P0-2
120
60
P0-3
122
63
P0-4
124
64
P0-5
126
66
P0-6
128
68
P0-7
130
70
P1-0
132
140
138
72
P1-1
134
P4-5
142
P4-6
144
P4-0
146

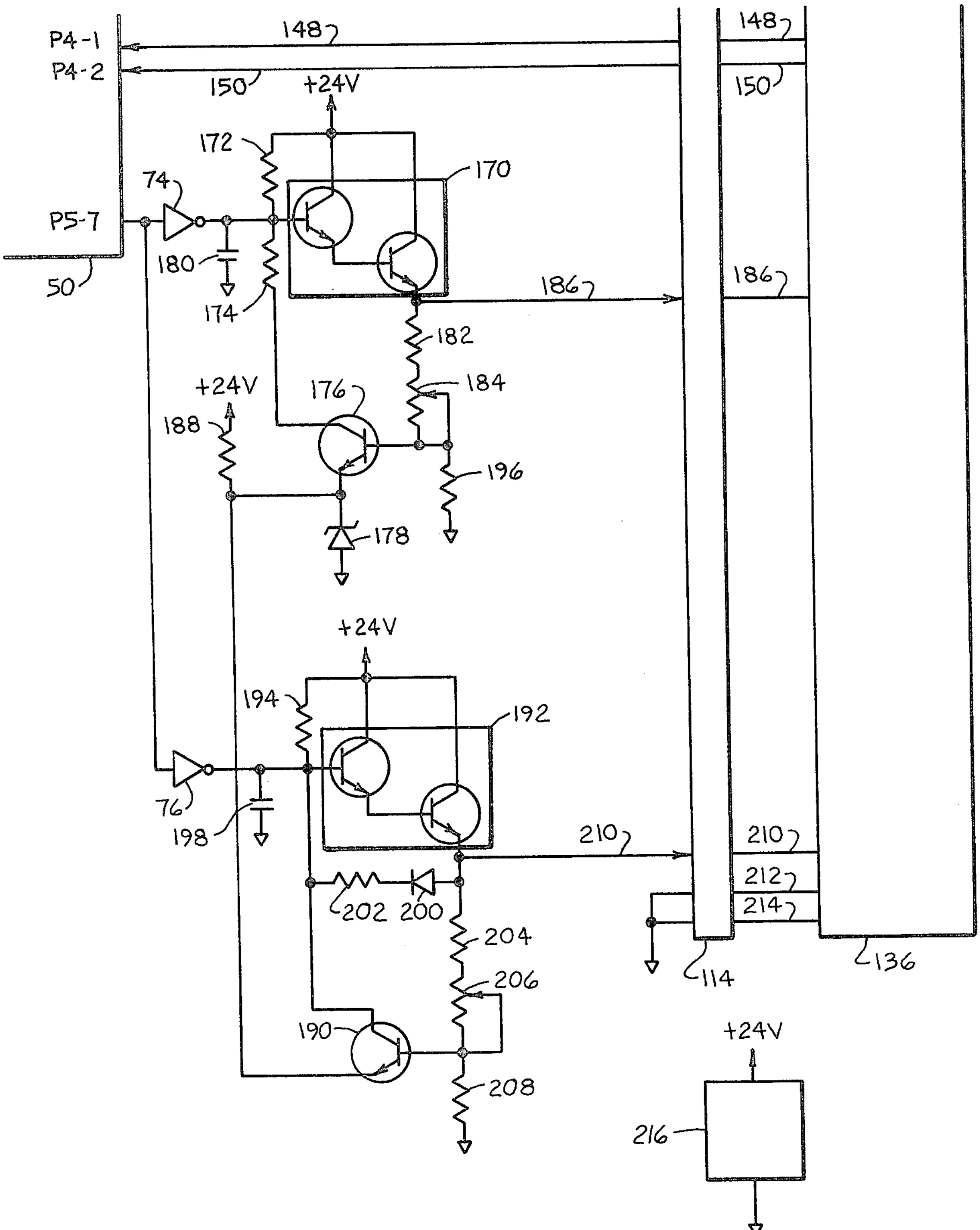

P4-1
P4-2
148
150
+24V
172
170
74
P5-7
180
50
174
186
182
184
+24V
176
188
196
178
+24V
194
192
76
198
210
212
214
202
200
204
206
114
136
190
208
+24V
216

Fig. 2.

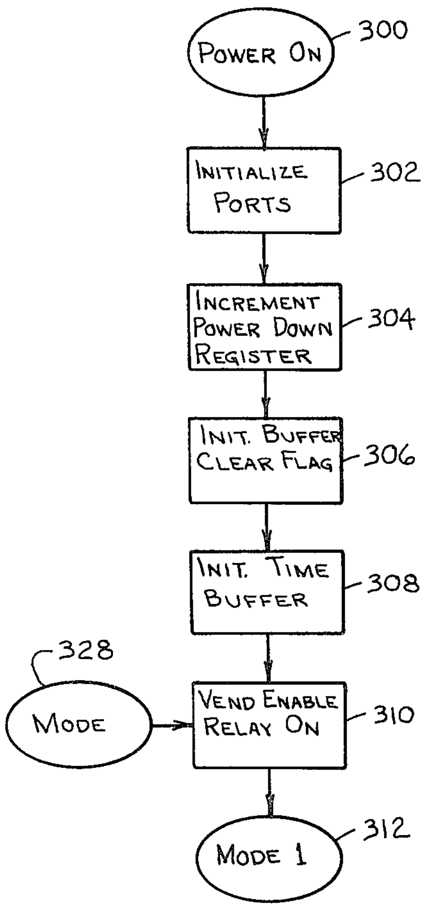

Power On
300
Initialize Ports
302
Increment Power Down Register
304
Init. Buffer Clear Flag
306
Init. Time Buffer
308
328
Mode
Vend Enable Relay On
310
Mode 1
312

Fig. 3.

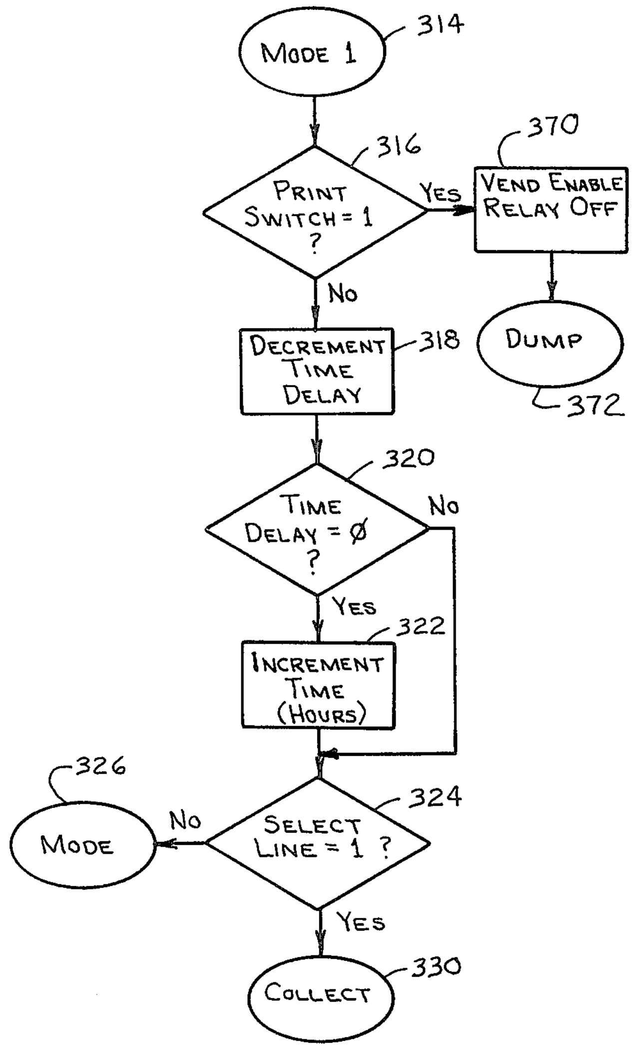

Mode 1
314
316
Print Switch = 1 ?
Yes
370
Vend Enable Relay Off
Dump
372
No
Decrement Time Delay
318
320
Time Delay = Ø ?
No
Yes
322
Increment Time (Hours)
326
Mode
No
324
Select Line = 1 ?
Yes
Collect
330

Fig. 4.

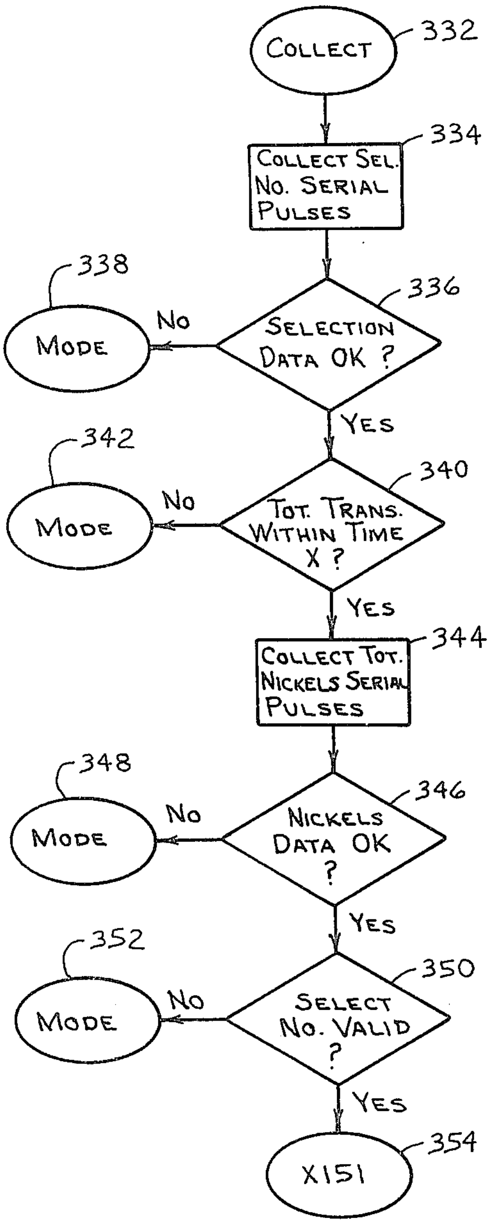

COLLECT
332
COLLECT SEL. NO. SERIAL PULSES
334
SELECTION DATA OK ?
336
NO
MODE
338
YES
TOT. TRANS. WITHIN TIME X ?
340
NO
MODE
342
YES
COLLECT TOT. NICKELS SERIAL PULSES
344
NICKELS DATA OK ?
346
NO
MODE
348
YES
SELECT NO. VALID ?
350
NO
MODE
352
YES
X151
354

Fig. 5.

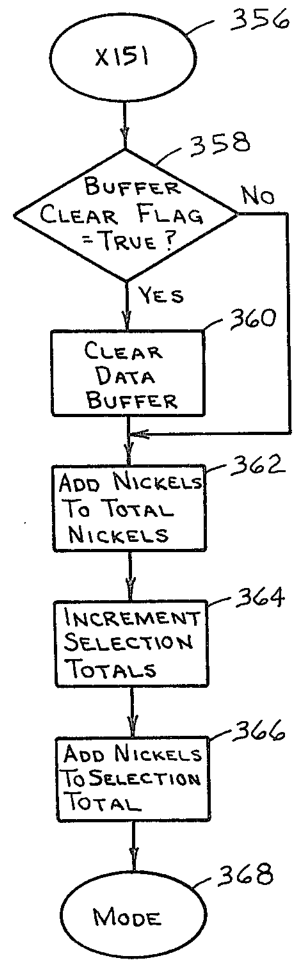

X151
356
BUFFER CLEAR FLAG = TRUE ?
358
NO
YES
CLEAR DATA BUFFER
360
ADD NICKELS TO TOTAL NICKELS
362
INCREMENT SELECTION TOTALS
364
ADD NICKELS TO SELECTION TOTAL
366
MODE
368

Fig. 6.

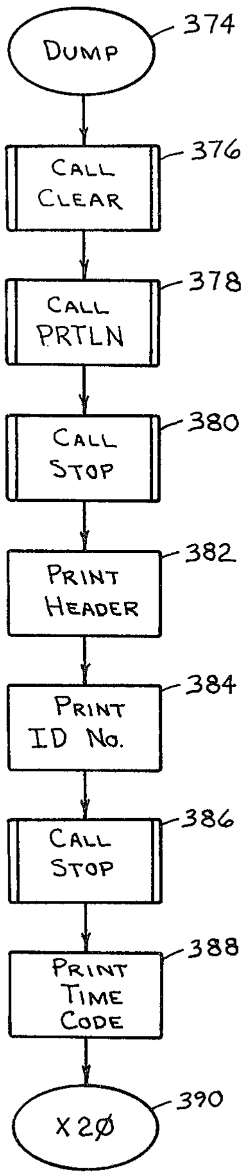

DUMP
374
CALL CLEAR
376
CALL PRTLN
378
CALL STOP
380
PRINT HEADER
382
PRINT ID No.
384
CALL STOP
386
PRINT TIME CODE
388
X2Ø
390

FIG. 7.

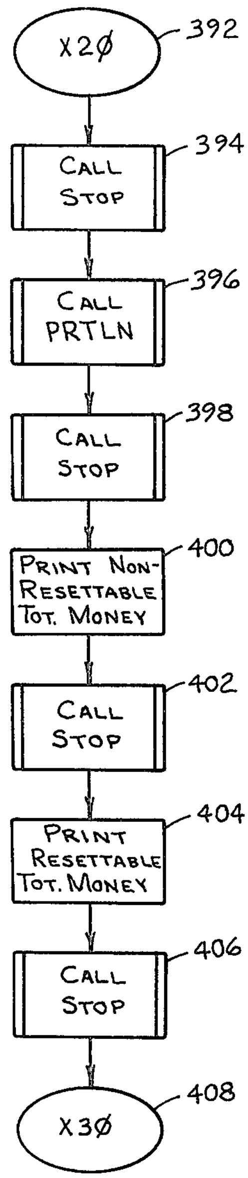

X2Ø
392
CALL STOP
394
CALL PRTLN
396
CALL STOP
398
PRINT NON-RESETTABLE TOT. MONEY
400
CALL STOP
402
PRINT RESETTABLE TOT. MONEY
404
CALL STOP
406
X3Ø
408

FIG. 8.

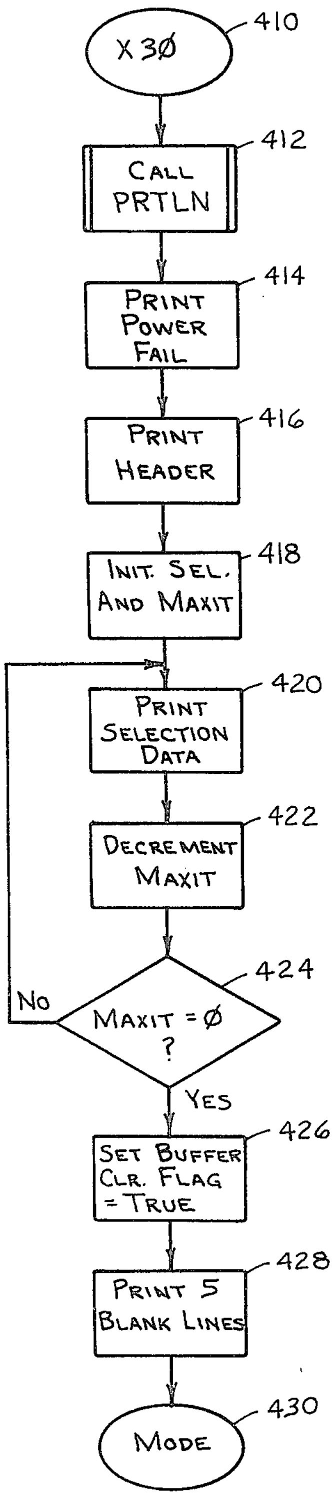

X 3Ø
410
CALL PRTLN
412
PRINT POWER FAIL
414
PRINT HEADER
416
INIT. SEL. AND MAXIT
418
PRINT SELECTION DATA
420
DECREMENT MAXIT
422
MAXIT = Ø ?
424
NO
YES
SET BUFFER CLR. FLAG = TRUE
426
PRINT 5 BLANK LINES
428
MODE
430

FIG. 9.

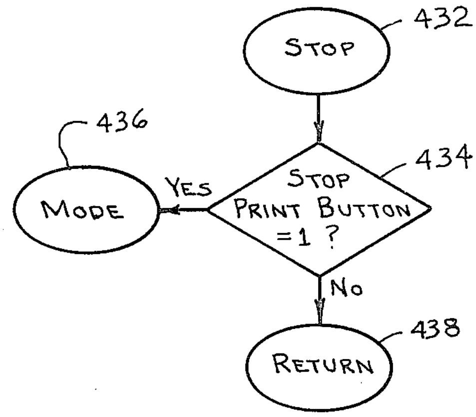

STOP
432
STOP PRINT BUTTON =1 ?
434
YES
MODE
436
NO
RETURN
438

FIG. 10.

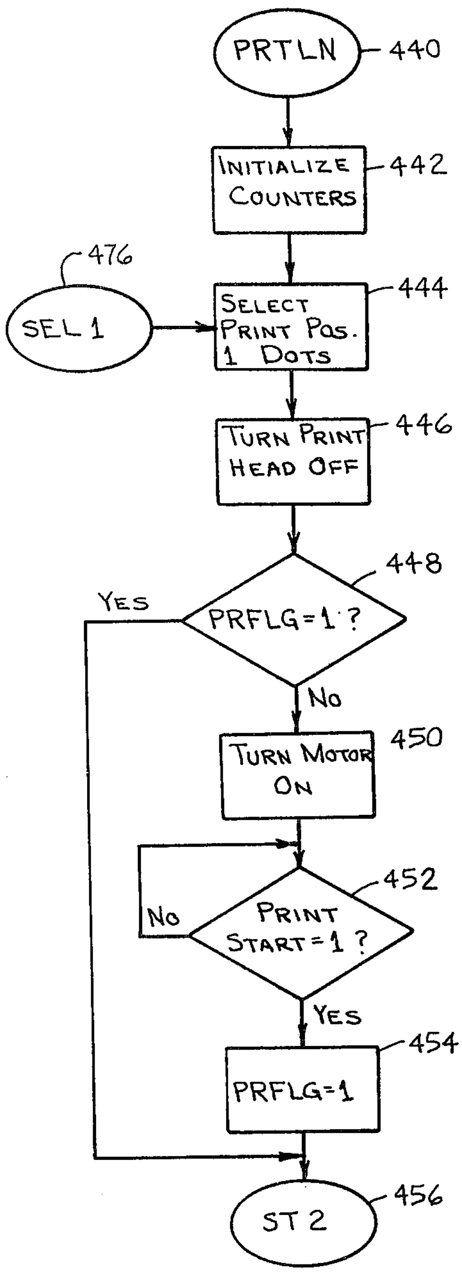

PRTLN
440
INITIALIZE COUNTERS
442
476
SEL 1
SELECT PRINT POS. 1 DOTS
444
TURN PRINT HEAD OFF
446
448
YES
PRFLG=1 ?
NO
TURN MOTOR ON
450
452
NO
PRINT START=1 ?
YES
PRFLG=1
454
ST 2
456

FIG. 11.

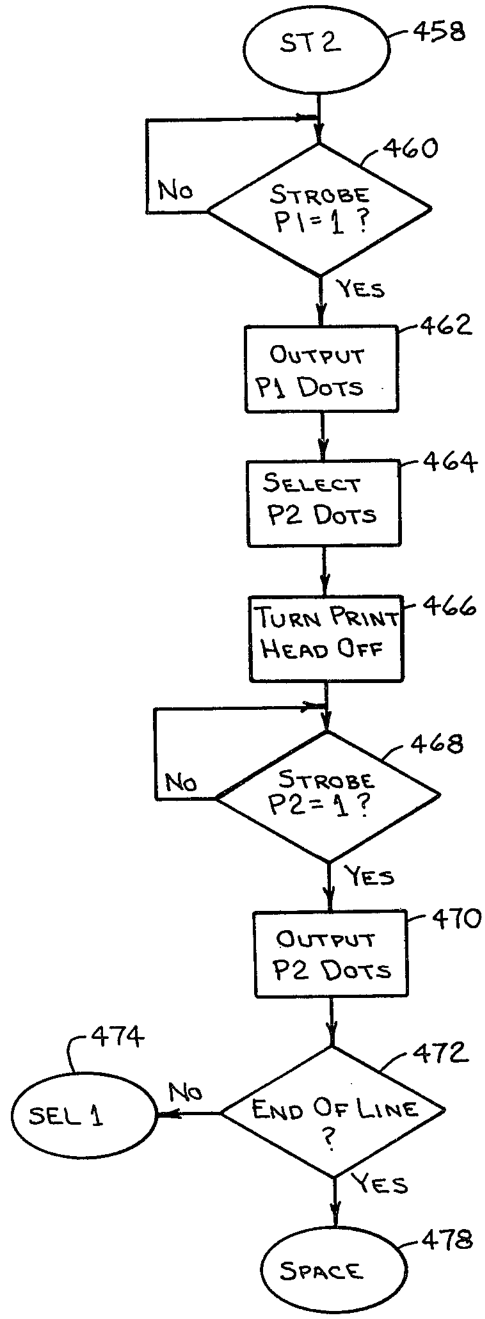

ST 2
458
460
NO
STROBE P1=1 ?
YES
OUTPUT P1 DOTS
462
SELECT P2 DOTS
464
TURN PRINT HEAD OFF
466
468
NO
STROBE P2=1 ?
YES
OUTPUT P2 DOTS
470
474
SEL 1
NO
END OF LINE ?
472
YES
SPACE
478

FIG. 12.

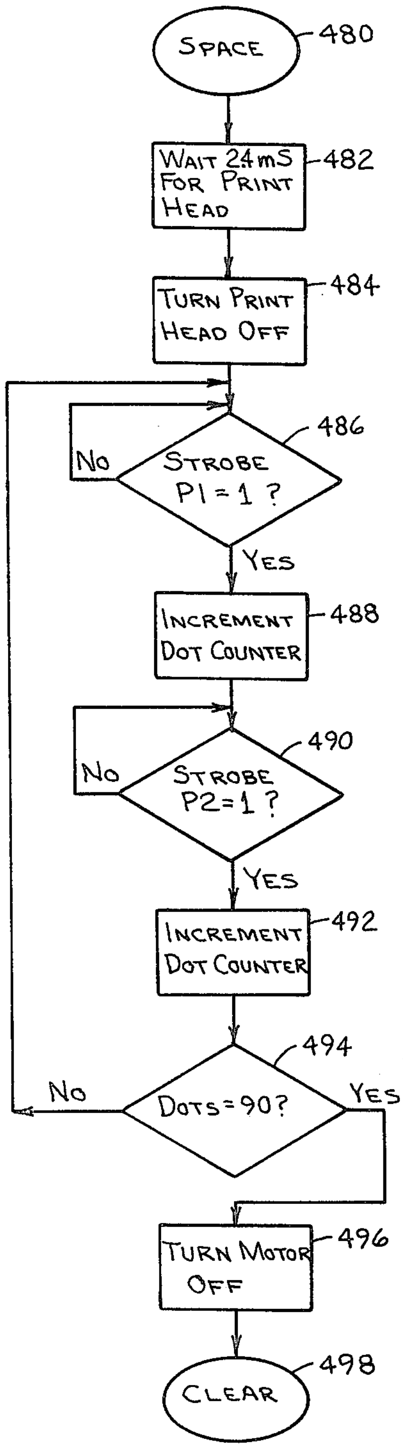

SPACE
480
WAIT 24mS FOR PRINT HEAD
482
TURN PRINT HEAD OFF
484
STROBE P1 = 1 ?
486
NO
YES
INCREMENT DOT COUNTER
488
STROBE P2=1 ?
490
NO
YES
INCREMENT DOT COUNTER
492
DOTS = 90?
494
NO
YES
TURN MOTOR OFF
496
CLEAR
498

FIG. 13.

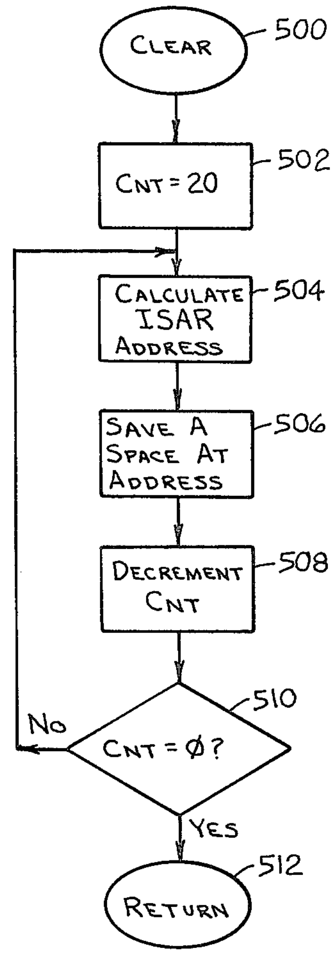

CLEAR
500
CNT = 20
502
CALCULATE ISAR ADDRESS
504
SAVE A SPACE AT ADDRESS
506
DECREMENT CNT
508
CNT = Ø ?
510
NO
YES
RETURN
512

FIG. 14.

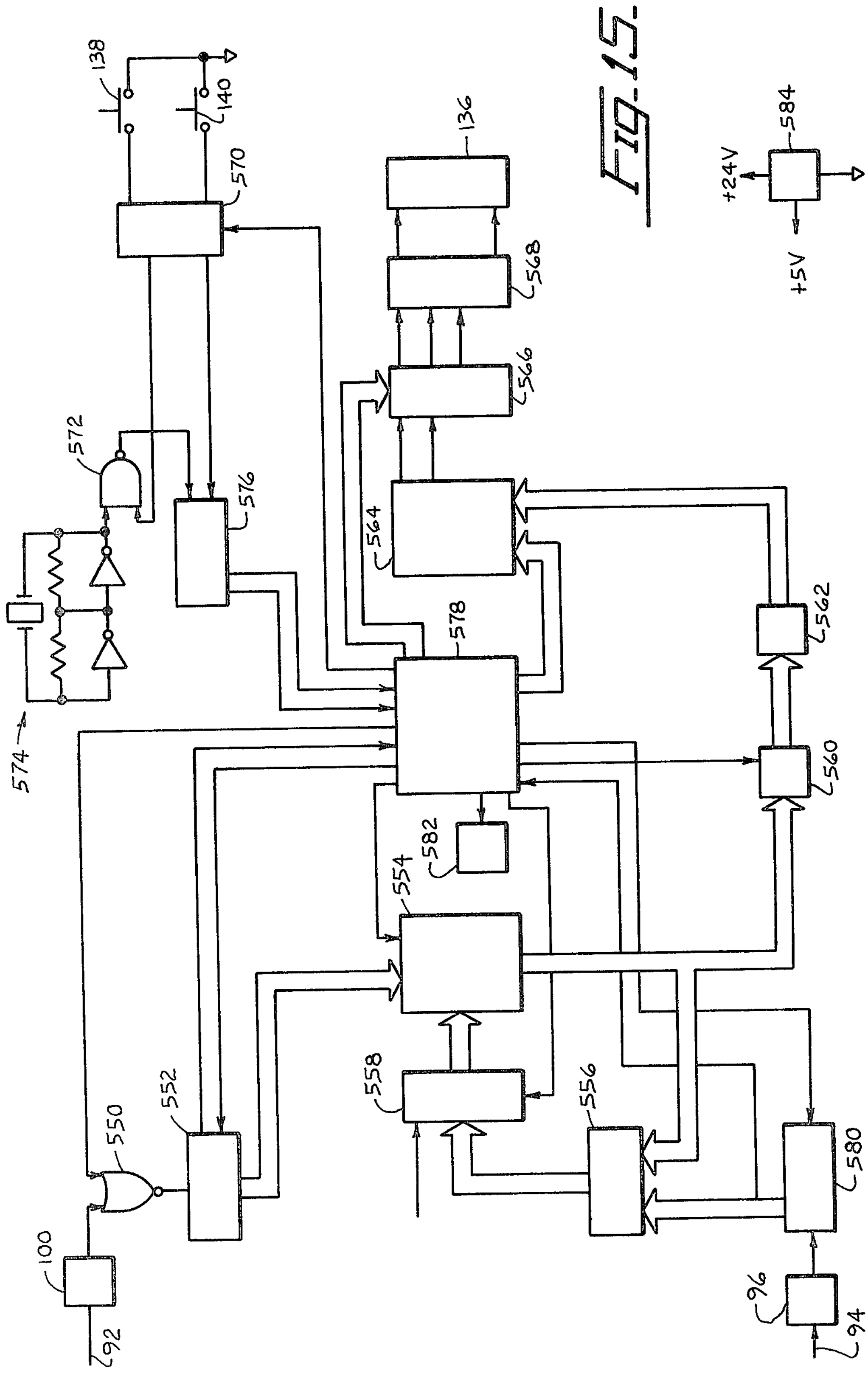

138
140
570
136
568
566
572
576
564
578
562
560
574
582
554
558
556
552
550
100
92
96
94
580
584
+24V
+5V

Fig. 15.

DATA ACQUISITION UNIT

BACKGROUND OF THE INVENTION

It is desirable to have a permanent, readily-available record of the number of vends of each product corresponding to the various selection switches of a vending machine; and it also is desirable to have a permanent, readily-available record of the total prices at which those products were vended. Various totalizers have been proposed which could be incorporated into vending machines to respond to vending operations to step up a counter which could be suitably read. However, the data provided by such devices, and the manner of supplying that data, have not been truly satisfactory.

SUMMARY OF THE INVENTION

The present invention mounts a data acquisition unit within a vending machine and connects it to the control device of that vending machine so it can receive serial bit streams from that control device. The data in one of those serial bit streams will include the number of vends of each product corresponding to the various selection switches of the vending machine, and the data in the other of those serial bit streams will include the price data. The data represented by the serial bit streams is recorded in two locations, one of which is re-settable, and the other of which is not resettable. A data-accepting unit can be connected to said data acquisition unit to accept corresponding data from said data acquisition unit. It is, therefore, an object of the present invention to provide a data acquisition unit which is connectable to the control device of a vending machine and which can transfer data to a data-accepting unit.

The data acquisition unit provided by the present invention is able, while it is in a data-yielding mode, to cause a printer to make a printout. That data acquisition unit can, while in said data-yielding mode, supply data to said printer without destroying or altering said data, whereby said printer can make duplicate, identical copies of printouts. It is therefore, an object of the present invention to provide a data acquisition unit which is able, while it is in a data-yielding mode, to supply data to a printer without destroying or altering said data, whereby that printer can make identical duplicate copies of printouts.

The data acquisition unit provided by the present invention is placed in a data-yielding mode by the closing of a circuit. That data acquisition unit will remain in that mode even after that circuit is re-opened. However, that data acquisition unit will respond to a subsequent vending operation of the vending machine, with which that data acquisition unit is used, to automatically shift out of said data-yielding mode.

The data acquisition unit provided by the present invention maintains a non-resettable record of the approximate length of time the vending machine, with which that data acquisition unit is used, has been in service. That record is printed on each printout, and hence aids in the interpretation of those printouts. It is, therefore, an object of the present invention to provide a data acquisition unit which maintains a non-resettable record of the approximate length of time the vending machine, with which that data acquisition unit is used, has been in service.

The data acquisition unit provided by the present invention senses and stores the number of times the electric power, that normally is supplied to it, is interrupted. The printout, which is made from data supplied by the data acquisition unit, directly indicates how many times power was interrupted between the time the printout was made and the last time data was unloaded from that data acquisition unit. That information could be very helpful in high-lighting attempts of persons to cheat the vending machine by "jiggling" the line cord. Also, that information could indicate if someone was trying to cheat the machine by disconnecting the data acquisition unit. It is, therefore, an object of the present invention to provide a data acquisition unit which will sense and record power interruptions.

The data acquisition unit of the present invention normally maintains a relay coil energized to complete a circuit of the control device of the vending machine. If, for any reason, the data acquisition unit were to be disconnected from power, were to experience a failure which could remove power from that relay coil, or were to be disconnected from the vending machine, that vending machine would be unable to accept coins. As a result, it would be virtually impossible for someone to disable the data acquisition unit without also disabling the vending machine. It is, therefore, an object of the present invention to provide a data acquisition unit which normally maintains a relay coil energized to complete a circuit of the control device of a vending machine.

The data acquisition unit provided by the present invention can be used with vending machines having a very large number—thirty-two (32)—of selection lines. However, that data acquisition unit also is usable with vending machines that have fewer selection lines; and it can automatically cause a printout to have a length that is proportional to the number of selection lines of the vending machine.

The data acquisition unit provided by the present invention receives all of its price data from the vending machine; and hence the data in that data acquisition unit will directly reflect price data corresponding to operations of that vending machine. As a result, when any of the prices of products are changed, the data which is received and stored by the data acquisition unit will automatically reflect the changed prices. It is, therefore, an object of the present invention to provide a data acquisition unit which receives all of its price data from the vending machine.

Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description, two embodiments of the present invention are shown and described, but it is to be understood that the drawing and accompanying description are for the purpose of illustration only and do not limit the invention and that the invention will be defined by the appended claims.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, FIGS. **1** and **2** show the circuit for one embodiment of data acquisition unit which is made in accordance with the principles and teachings of the present invention,

FIGS. **3–14** constitute a flow chart of the operation of that data acquisition unit, and

FIG. **15** is a block diagram of a hardware version of that data acquisition unit.

COMPONENTS

The numeral **50** denotes a microprocessor which is one part of a microcomputer module that is connected to a coin changer **51** for a vending machine by a plug and socket **33** and conductors **31, 92, 94, 161** and **163**. Although that microprocessor has been shown larger than that coin changer, the overall module which includes that microprocessor is smaller than that coin changer; and both that module and that coin changer will be mounted within the same vending machine. That module includes, among other things, a Fairchild F8 3850CPU, a Fairchild F8 3853SMI, a Fairchild F8 3861PIO, a PROM, a RAM and a back-up battery. The numerals **52, 54, 56, 58, 60, 63, 64, 66, 68, 70, 72, 74** and **76** denote inverter drivers. Although various inverter drivers could be used, it is desirable to use a Sprague Electronic ULN2003N as seven of those inverter drivers, and to use six-sevenths of another ULN2003N as six of those inverter drivers.

Pin **6** of Port **5** of microprocessor **50** can supply a "relay enable" signal to the input of inverter driver **52**; and a resistor **78** and a relay coil **80** are connected between the output of that driver and plus twenty-four (+24) volts. A flyback diode **82** is connected in parallel with the series-connected resistor **78** and coil **80**. The numeral **84** denotes a stationary contact which is connected, via conductor **163**, plug and socket **33**, resistor **162** and conductor **98**, to pin **6** of Port **4** of a microprocessor **62** of a control device for a vending machine. A pull up resistor **160** connects the conductor **98** to plus five (+5) volts. The numeral **90** denotes a movable contact which is biased for movement out of engagement with the contact **84**, but which is pulled into engagement with that contact whenever relay coil **80** is energized. That movable contact is connected by a conductor **161** and the plug and socket **33** to an opto-coupler **154** which receives a signal from a line L6 of a vending machine via a resistor **158** and a diode **156**. Although various devices could be used, the microprocessor **62**, resistors **158, 160** and **162**, opto-coupler **154** and diode **156** preferably are identical to the similarly-numbered components in Hasmukh R. Shah et al application for Control Device, Serial No. 137,524, filed of even date.

The plug and socket **33** have five pins; and pins **4** thereof interconnect sections of conductor **161**, and pins **5** thereof interconnect sections of conductor **163**. The numerals **96** and **100** denote opto-couplers; and resistors **102** and **104** connect one input terminal of each of those opto-couplers to the conductor **31** which is connected by plug and socket **33** to a source of plus twelve (+12) volts in the changer **51**. The other input terminal of opto-coupler **96** is connected by conductor **94** and plug and socket **33** to pin **1** of Port **5** of the microprocessor **62** of said Shah et al application. The other input terminal of opto-coupler **100** is connected by conductor **92** and plug and socket **33** to pin **4** of Port **5** of the microprocessor **62** of said Shah et al application. The emitters of the phototransistors of each of the opto-couplers **96** and **100** are grounded. The output of opto-coupler **96** is connected to pin **3** of Port **4** of microprocessor **50**; and that opto-coupler will supply to that pin a serial bit stream wherein each bit will represent five cents (5¢). The output of opto-coupler **100** is connected to pin **4** of Port **4** of microprocessor **50**; and that opto-coupler will supply to that pin a signal which will identify the selection switch that initiated the vending operation which led to the serial bit stream on conductors **92** and **94**.

The numerals **106** and **108** denote two eight channel multiplex/demultiplexers (hereinafter MUX); and each of them has its A, B, C and INH inputs connected, respectively, to pins **0–3** of Port **5** of microprocessor **50**. The **0** through **7** pins of MUX **106** are connected to eight position DIP switches **110**; and the **0** through **7** pins of MUX **108** are connected to eight position DIP switches **112**. The contacts of those switches can be set to provide a binary code which will positively identify the vending machine in which the data acquisition unit is located. Pins **0** through **3** of Port **5** of microprocessor **50** supply successive binary words to the A,B,C and INH inputs of each MUX, and thereby selectively connect switches in the DIP switches **110** or **112** to the Out pin of that MUX.

Conductors **116, 118, 120, 122, 124, 126, 128, 130, 132** and **134** and plug and socket **114** and current-limiting resistors connect the outputs of inverter drivers **54, 56, 58, 60, 63, 64, 66, 68, 70** and **72**, respectively, to the inputs of a printer **136** to control the thermal elements in the print head of that printer. Although various MUX could be used as the MUX **106** and **108**, two Motorola MC14051B eight channel multiplexer/demultiplexers are preferred. Although various printers could be used as the printer **136**, an Olivetti Model PU1800/B/18 thermal printer is preferred.

The numeral **138** denotes a normally-open push button switch which has one terminal thereof grounded, and which has the other terminal thereof connected, by a conductor **142** and plug and socket **114**, to pin **5** of Port **4** of microprocessor **50**. The closing of that switch will supply a signal to microprocessor **50** which will produce a command to printer **136** to print. The numeral **140** denotes a further normally-open push button switch which has one terminal thereof grounded, and which has the other terminal thereof connected, by a conductor **144** and plug and socket **114**, to pin **6** of Port **4** of that microprocessor. Closing of that switch will apply a "stop print" command to microprocessor **50**.

Conductors **146, 148**, and **150** and plug and socket **114** connect pins **0–2** of Port **4** of the microprocessor **50** to the printer **136**. Conductor **146** will provide a "start" strobe to pin **0** of Port **4** of that microprocessor when the printing unit of the printer **136** is in position to start printing a fresh line. Conductor **148** will provide a "**P1**" strobe to pin **1** of Port **4** each time the printing unit is in position to start printing the dots which help define the odd-numbered dots in a given row. Because the printing unit prints as it moves from right to left, as well as when it moves from left to right, the P1 strobe will occur at opposite sides of digits in adjacent rows. The numeral **150** denotes a conductor which supplies a "**P2**" strobe to pin **2** of Port **4** each time the printing unit is in position to start printing the even-numbered dots in a given row.

The numeral **170** denotes a Darlington amplifier; and one Darlington amplifier that is very useful is a Texas Instruments TIP-110. The numeral **192** denotes a similar Darlington amplifier.

A resistor **182**, an adjustable resistor **184**, and a resistor **196** are connected between the output of Darlington amplifier **170** and ground. Resistors **172** and **174** are connected in series between plug twenty-four (+24) volts and the collector of an NPN transistor **176**. The junction between those resistors is connected to the input of Darlington amplifier **170**; and the junction between adjustable resistor **184** and resistor **196** is connected to the base of transistor **176**. A resistor **188** and a Zener diode **178** are connected between plus twenty-four (+24) volts and ground; and the junction between them is connected to the emitter of transistor **190**. A resistor **204**, an adjustable resistor **206** and a resistor **208** are connected in series between plus twenty-four (+24) volts and ground. A resistor **194** and transistor **190** are connected between plus twenty-four (+24) volts and the cathode of Zener diode **178**; and the junction between that resistor and that transistor is connected to the input of Darlington amplifier **192**. The junction between adjustable resistor **206** and resistor **208** is connected to the base of transistor **190**.

The Darlington amplifier **170**, transistor **176** and their associated resistors serve as a "keyed" power supply—in the sense that they can be turned "on" and "off" very rapidly. Similarly, the Darlington amplifier **192**, transistor **190** and their associated resistors serve as a "keyed" power supply—in the sense that they can be turned "on" and "off" very rapidly. The Zener diode **178** provides a fixed reference voltage for the two "keyed" power supplies. Resistor **188** provides a bias current for that Zener diode; and hence that Zener diode is able to provide a reference voltage which is essentially independent of the conductive or non-conductive states of the transistors **176** and **190**. Inverter **74** connects pin **7** of Port **5** of microprocessor **50** to the input of Darlington amplifier **170**; and inverter **76** connects that pin to the input of Darlington amplifier **192**. A capacitor **180** is connected between the output of inverter **74** and ground; and, similarly, a capacitor **198** is connected between the output of inverter **76** and ground.

A conductor **186** extends from the output of Darlington amplifier **170** to the thermal heads of printer **136** via plug and socket **114**; and that conductor can supply an excitation voltage to those thermal heads. That voltage can be turned "on" or "off" by the logic level at pin **7** of Port **5**; but the value of that voltage will be controlled by the setting of adjustable resistor **184**. Specifically, that adjustable resistor and resistors **182** and **196** constitute a voltage divider which is connected between conductor **186** and ground; and the voltage at the upper terminal of resistor **196** is applied to the base of transistor **176**. That transistor amplifies any difference between the voltages across Zener diode **178** and resistor **196**; and, if the voltage across resistor **196** tends to be greater than that across Zener diode **178**, transistor **176** will become more conductive. The resulting increase in IR drop across resistor **172** will decrease the input voltage of Darlington amplifier **170**; and the consequent reduced conductivity of that Darlington amplifier will decrease the voltage on conductor **186** to the desired value. As a result, the Darlington amplifier, transistor **176** and their associated resistors constitute a voltage regulator as well as a "keyed" power supply.

Capacitor **180** and resistor **174** provide high-frequency compensation for that combination voltage regulator and "keyed" power supply. As a result, they made certain that no oscillations can develop.

Similarly, the Darlington amplifier **192**, transistor **190** and their associated resistors constitute a voltage regulator as well as a "keyed" power supply. A conductor **210** and plug and socket **114** will apply any voltage at the output of Darlington amplifier **192** to the printer **136**; and that voltage will be the supply voltage for the motor of that printer. The capacitor **198** will provide high-frequency compensation for that combination voltage regulator and "keyed" power supply. As a result, it makes certain that no oscillation can develop.

When pin **7** of Port **5** of microprocessor **50** applies a logic "1" to the inputs of inverters **74** and **76**, the resulting "0"s will be applied to the inputs of the Darlington amplifiers **170** and **192**. The outputs of those Darlington amplifiers also will be "0"s, and hence the thermal heads and the motor of printer **136** will not be excited. However, if pin **7** of Port **5** applies a logic "0" to the inputs of inverters **74** and **76**, the resulting "1"s at the inputs of the Darlington amplifier will start the motor of printer **136** and will make power available to the thermal heads of that printer. Significantly, the states of pins **0** through **7** of Port **0** and the states of pins **0** and **1** of Port **1** of microprocessor **50** will determine which, if any, of those thermal heads can be excited.

A resistor **202** and a diode **200** are connected in series relation between the output and input of Darlington amplifier **192**; and they will coact with that Darlington amplifier to provide dynamic braking for the motor of printer **136**. Specifically, whenever the logic state of pin **7** of Port **5** changes from "0" to "1", the voltages at the input and output of Darlington amplifier **192** will drop to zero (0). Thereupon, the series-connectd diode **200** and resistor **202** will be grounded by inverter **76**; and hence the inductive energy in the motor will be passed to ground. Although the motor of the printer was, at the instant the logic state of pin **7** of Port **5** changed from "0" to "1", operating at its rated speed, the rotor of that motor will stop almost immediately. The numeral **300** in FIG. 3 denotes the step of applying power to the coin changer **51** and to the microprocessor **50**. The numeral **302** denotes the initialization of all ports of that microprocessor. In step **304**, wherein power is re-applied after each accidental cutting off of power, the HEX 200A register of step **304** will respond to the execution of that step to increment the count in that register. As a result, that count constitutes a running record of the number of "turn ons" since the last time data was withdrawn from the data acquisition unit. That count can be important in high-lighting attempts of persons to "cheat" the vending machine or the data acquisition unit by "jiggling" the electric plugs in the sockets therefor. Also, that count can be important in high-lighting the number of times the vending machine or the data acquisition unit are turned off between periods when data is withdrawn from that data acquisition unit. Step **306** is entitled INIT. BUFFER CLEAR FLAG and it corresponds to lines **1090** through **1110** of the program. During that step, a flag—which can be set to effect the erasing of data in a data buffer—will be set to zero (0); and hence, during the executions of all steps of the program prior to the step wherein that flag is set, the data in that buffer will not be erased. Step **308** is entitled INIT. TIME BUFFER and it corresponds to lines **1140** through **1190** of the program. During that step, a timing function—which is intended to "time out" approximately once each hour—will be set to provide a full hour timing function even if, during a prior timing function, the power had failed and thereby permitted only a partial timing function to be performed. This means that the initialization of the data acquisition unit always provides a known starting time base. That timing function will automatically and continually repeat itself as long as the data acquisition unit is "on"—without any need of re-executing that step.

The numeral **310** denotes a step which is entitled VEND ENABLE RELAY ON and which corresponds to lines **1210** through **1220** of the program. During that step, the logic state of pin **6** of Port **5** of microprocessor **50** will be set to energize relay coil **80** of FIG. **1**. Thereupon, movable contact **90** will shift into engagement with contact **84** to complete a circuit from line **6** of the vending machine via resistor **158**, diode **156**, opto-coupler **154**, conductor **161**, plug and socket **33**, contacts **90** and **84**, conductor **163**, plug and socket **33**, resistor **162** and conductor **98** to pin **6** of Port **4** of the microprocessor **62** in the coin changer **51**. The energization of relay coil **80**, and the consequent closing of contacts **90** and **84**, will enable the coin changer **51** to accept coins.

The numerals **312** and **314** denote connectives of FIGS. **3** and **4** which are entitled MODE **1** and which will cause the program to initiate the execution of step **316**—which is entitled PRINT SWITCH=1? and which corresponds to lines **1300** through **1320** of the program. During that step, a comparing function will be performed to determine whether or not switch **138** of FIG. **1** is closed. If that comparing function provides a NO, step **318**—which is entitled DECREMENT TIME DELAY and which corresponds to lines **1360** through **1460** of the program—will be executed. During that step, one of four registers of the time buffer, which were initialized during step **308**, will be decremented. The count, which is initialized into those registers during step **308**, will cause normal looping of the program to require an hour before that count is decremented to zero (0). The initializing and decrementing of the registers of step **318** will automatically and continually repeat themselves as long as the data acquisition unit is "on"—without any need of re-executing that step. Step **320** is entitled TIME DELAY=0? and it corresponds to line **1470** of the program; and, during that step, a comparing function will determine whether the registers of step **318** have been counted down to zero (0). Step **322** is entitled INCREMENT TIME (HOURS) and it corresponds to lines **1480** through **1630** of the program; and, during that step, the number of times the registers of step **318** have been incremented will be stored in the HEX **2002** and HEX **2003** RAM locations.

Step **324** is entitled SELECT LINE=1? and it corresponds to lines **1650** through **1670** of the program. If the comparing function of step **320** provided a YES, step **322** would increment the HEX **2002** and HEX **2003** locations which constitute a 14-bit timer register. However, when, as happens most frequently, the comparing function of step **320** provides a NO, step **322** will be bypassed; and step **324** will perform a comparing function to ascertain whether the logic state on conductor **92** of FIG. **1** is a "1". If that function provides a NO, MODE connectives **326** and **328**, respectively, of FIGS. **4** and **3** will branch the program to step **310**. That step will make certain that relay coil **80** of FIG. **1** is energized—thereby making certain that relay contacts **84** and **90** are closed. Steps **310**, **316**, **318**, **320** and **324** constitute a loop which will be executed repeatedly through most of the time the data acquisition unit is "on". Specifically, that loop will be executed at all times when the registers of steps **308** and **318** are being decremented toward zero (0). Those registers will progressively decrement to zero (0), automatically initialize themselves to their originally-initialized count, and then start incrementing to zero (0). As a result, those registers will repeatedly and continually produce timing periods which will time out in approximately one hour. Each time one of those timing periods "times out", the time register of step **322** will be incremented to provide a running count of the number of times that time relay is decremented to zero (0).

Whenever an execution of the routine of FIGS. **3** and **4** causes the comparing function of step **324** to provide a YES, the COLLECT connectives **330** and **332** of FIGS. **4** and **5** will initiate step **334** of FIG. **5**—which is entitled COLLECT SEL. NO. SERIAL PULSES and which corresponds to steps **1710** through **2090** of the program. During that step, the number of pulses, which are supplied to pin **4** of Port **4** of microprocessor **50** by the microprocessor **62** via conductor **92** and opto-coupler **100**, will be counted and then stored in register **3**. Step **336** is entitled SELECTION DATA O.K.? and it corresponds to lines **1800** and **1880** of the program—and hence overlaps some of the lines of step **334**. During that step, the width of each pulse on the conductor **92** is checked; and any pulse having less than a predetermined width will cause the whole series of pulses to be ignored, and also will cause the program to branch via mode connective **338** and connective **328**, respectively, of FIGS. **5** and **3** to step **310**. Thereupon, the program will loop through that step, the routine of FIG. **4**, and step **334** of FIG. **5** to step **336** until a YES is provided by the latter step. The widths of the pulses on the conductor **92** should have a period (between the leading edges of adjacent pulses) of five milliseconds (5 ms); but step **336** will accept all pulses which have widths that are within twenty percent (20%), plus or minus, of that value.

Step **340** of FIG. **5** is entitled TOT. TRANS WITHIN TIME X, and it corresponds to lines **2100** through **2200** of the program. During that step, a determination will be made of whether the first price pulse, which the microprocessor **62** will apply to conductor **94**, was received within fifty milliseconds (50 ms) of the last selection line pulse that was received on conductor **92**. If the answer is NO, the coin changer **51** probably is in the "free vend mode"—wherein products can be dispensed by the vending machine but the money is handed directly to the operator rather than being inserted in the coin slot of that vending machine. In such event, the program will branch, via MODE connective **342** and connective **328**, respectively, of FIGS. **5** and **3** to step **310** of FIG. **3**. The program will then loop through that step and the routine of FIG. **4** until a logic "1" again appears on conductor **92**.

Each selection switch of the vending machine is assigned a selection line number; and the lowest number is three (3)—to keep the pulses which are used to identify that selection line number from being simulated by a voltage spike, noise or another transient, as could happen if one of the selection line numbers was one (1). The number of selection lines in the control device of the said Shah et al application is thirteen (13); but the data acquisition unit of the present invention can store and supply data corresponding to as many as thirty-two (32) selection lines. The number corresponding to the last selection line of a vending machine having thirty-two (32) selection switches would be thirty-four (34). As a result, the number of pulses in each group of pulses that are received on conductor **92** in the form of a serial bit train with time periods of five milliseconds (5 ms) will constitute the number of a selection line plus two (2).

The numeral **344** denotes a step which is entitled COLLECT TOT. NICKELS SERIAL PULSES and which corresponds to lines **2220** through **2660** of the program. During that step the total number of bits, in the groups of bits of the serial bit stream which the microprocessor **62** applies to conductor **92**, will be collected and stored in register **4**. During step **346**—which is entitled NICKELS DATA O.K.? and which corresponds to line **2340** of the program, and hence overlaps some of the lines of step **344**—the widths of the pulses on conductor **94** will be checked. Those pulses have a time period of one hundred milliseconds (100 ms) and a duty cycle of fifty percent (50%). Any pulses which vary as much as twenty percent (20%), plus or minus, from that time period will be considered invalid pulses; and hence the program will branch, via MODE connective **348** and connective **328** of FIG. **3**, to step **310** of FIG. **3**. Thereupon, the program will loop—through that step, the routine of FIG. **4**, and part of the routine of FIG. **4** to step **324**—until pulses are again applied to conductor line **92** by microprocessor **62**.

Step **350** of FIG. **5** is entitled SELECT NO. VALID? and it corresponds to lines **2670** through **2700** of the program. During that step, the number of pulses which are received on the conductor **92**, during any serial bit stream, will be checked to determine whether or not that number exceeds the maximum number of selections that the data acquisition unit is capable of storing. If the answer is NO, the program will branch via MODE connective **352** and connective **328** in FIG. **3** to step **310** in FIG. **3**; and then the program will loop through that step **310** and the routine of FIG. **4** to step **324** —until further pulses are noted on conductor **92**. If a YES is produced by step **350**, the program will branch, via **X151** connective **354** and a similarly-identified connective **356** of FIG. **6**, to step **358** of FIG. **6**—which is entitled BUFFER CLEAR FLAG=TRUE? and which corresponds to lines **2720** through **2750** of the program. During that step, the state of the data buffer will be checked to determine whether an inventory function—wherein data was withdrawn from the data acquisition unit—had been performed. The initial state of the data buffer flag is set to "false" during step **306**; and, if it still is "false", the program will branch to step **362** which is entitled ADD NICKELS TO TOTAL NICKELS and which corresponds to lines **3050** through **3070** of the program. If that buffer clear flag equals "true"—as it will after an inventory has been taken by the route man, the comparing function of step **358** will provide a YES; and then step **360**, which is entitled CLEAR DATA BUFFER and which corresponds to lines **2790** through **3020** of the program, will clear sixty-five (65) buffers in the RAM in the microprocessor **50**, which constitute a portion of the data buffer. At the conclusion of that clearing operation, step **360** will again set the buffer clear flag to "false". Consequently, during the next execution of step **358**, the answer will be NO—and the program will by-pass step **360**—unless a further inventory function has been performed. At this time, the program will have cleared all re-settable data from the data buffer, because all of that re-settable data would have been transferred to the printer **136** during an inventory function—all as explained hereinafter.

The data acquisition unit establishes and up-dates several groups of running counts—a non-resettable count of the number of times—"hours"—during which the time register of step **308** has been recurrently decremented to zero (0), a non-re-settable count of the total of the prices of all products vended by the vending machine—other than during "free vends", a group of non-re-settable running counts of the numbers of products which have been vended when each of the selection switches of the vending machine has been pressed, a group of non-re-settable running counts of the total of the prices of the products which have been vended when each of the selection switches of the vending machine has been pressed, a group of re-settable running counts of the numbers of products, which were vended since the last inventory function was performed, when each of the selection switches of the vending machine was pressed, a re-settable running count of the total of the prices of all products, which were vended since the last inventory function was performed, and a re-settable running count of the number of power interruptions since the last inventory function was performed. Those running counts constitute statistical data which can be important in the continued operation of the vending machine.

During step **362**, some of the data which was received on conductor **94** as a serial bit stream will be added to the data in RAM locations HEX **2004** through HEX **2008**. Specifically, the non-re-settable running count—of the total of the prices of all products vended by the vending machine, other than during "free vends" and which is stored in the HEX **2004** and HEX **2005** locations in the RAM—will be incremented; and the re-settable running count—of the total of the prices of all products which were vended since the last inventory function was performed, and which is stored in the HEX **2007** and HEX **2008** locations in the RAM—will be incremented.

Step **364** is entitled INCREMENT SELECTION TOTALS and it corresponds to lines **3090** through **3720** of the program; and, during that step, the data in register **3** will be used to address the locations in the RAM where the data corresponding to the selection line numbers are located. At such time, the re-settable and the non-re-settable running counts —of the number of products vended in response to the actuation of the currently-addressed selection line—will be incremented by one (1). Also during step **364**, the MAXIT register will be set. Step **366** is entitled ADD NICKELS TO SELECTION TOTAL and it corresponds to lines **3730** through **3810** of the program. During that step, the count which represents the dollar value—in five cents (5¢) units—of the product that was just vended by the vending machine will be added to the non-re-settable running count of that same product, and also will be added to the re-settable count of that product. Thereafter, the program will branch, via MODE connective **368**—which corresponds to line **3860** of the program—to connective **328** of FIG. **3** to initiate further routines of FIG. **4** until further pulses are noted on conductor **92**.

When, during a looping of the program through the routine of FIG. **4**, step **316** determines that switch **138** of FIG. **1** has been closed, a YES will be provided by that step; and step **370** will then be executed. That step is entitled VEND ENABLE RELAY OFF and it corresponds to lines **1330** through **1340** of the program; and, during that step, pin **6** of Port **5** of microprocessor **62** will change its state so relay coil **80** will become de-energized and movable contact **90** will shift away from fixed contact **84**. Thereupon, the coin changer **51** will become incapable of accepting further coinage until the state of that pin is changed back to its "relay enable" state. The program will then branch—via DUMP connective 372 which corresponds to line 1350 of the program and correspondingly-identified connective 374 of FIG. 7—to a subroutine 376 of FIG. 7 which is entitled CALL CLEAR and which corresponds to line 4590 of the program. During that sub-routine—which is shown in detail by FIG. 14—the print buffer will be cleared by setting the ASCII character for blank space therein. Twenty (20) scratch pad registers, namely, 16 through 35, store the data which constitutes the print buffer; and the ASCII character for blank space is HEX 20. The number 378 in FIG. 7 denotes a sub-routine which is entitled CALL PRTLN and which corresponds to line 4650 of the program; and that sub-routine is shown in detail by FIGS. 11-13. During that sub-routine, whatever data is in the print buffer will be printed by the printer 136—all as shown by the steps of FIGS. 11 through 13.

Step 380 of FIG. 7 is a sub-routine entitled CALL STOP and it corresponds to line 4660 of the program; and the step of that sub-routine is shown by FIG. 10. During step 434 of FIG. 10—which corresponds to step 380 of FIG. 7, which is entitled STOP PRINT BUTTON=1?, and which corresponds to lines 8670 through 8690 of the program—the state of switch 140 of FIG. 1 will be checked. If that switch is closed, the program will jump, via MODE connective 436 of FIG. 10 to connective 328 of FIG. 3; and then will loop through step 310 and the routine of FIG. 4 until either a further series of pulses is noted on conductor 92 or the print switch 138 of FIG. 1 is closed. Step 310 of FIG. 3 will be executed immediately upon the re-entry of the program at connective 328—with consequent re-energization of relay coil 80—so the coin changer can again accept coins and thereby resume its normal operation.

Step 382 of FIG. 7 is entitled PRINT HEADER and it corresponds to lines 4700 through 5000 of the program. During that step, the print buffer will be loaded with data corresponding to the first line of the heading of the printout; and then the sub-routine of FIGS. 11 through 13 will be called to effect the printing of the data in the print buffer. A representative printout is shown hereinafter:

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NATIONAL REJECTORS
DATA ACQUISITION
SYSTEM

ID#		51156	
TH		00000	
TNR	$	0004.25	
TR	$	0004.00	
P1		000	
S#	IR	INR	$NR
01	003	00003	0003. 00
02	000	00000	0000. 00
03	000	00000	0000. 00
04	000	00000	0000. 00
05	000	00000	0000. 00
06	000	00000	0000. 00
07	000	00000	0000. 00
08	000	00000	0000. 00
09	000	00000	0000. 00
10	000	00000	0000. 00
11	000	00000	0000. 00
12	000	00000	0000. 00
13	004	00005	0001. 25

At the conclusion of the sub-routine of FIGS. 11 through 13, the print buffer will automatically be loaded with HEX 20 ASCII characters which call for blank spaces. The sub-routine of FIGS. 11-13 and the subsequent loading of the print buffer with HEX 20 ASCII characters will occur as often as required to print the heading of the print out. In one preferred embodiment of the present invention that heading consists of six (6) lines; and the last execution of the sub-routine of FIGS. 11-13, which is needed to effect the printing of the heading, will load the HEX 20 ASCII characters into the print buffer.

The numeral 384 in FIG. 7 denotes a step which is entitled PRINT ID NO and which corresponds to lines 5040 through 5560 of the program. During that step, the states of the eight position DIP switches 110 and 112 of FIG. 1 will be read to load the print buffer; and then the sub-routine of FIGS. 11-13 will be called to print a line corresponding to the data in that buffer.

The numeral 386 denotes a further CALL STOP sub-routine, and it corresponds to line 5600 of the program. During that sub-routine, the state of switch 140 in FIG. 1 will again be checked by step 434 of FIG. 10—all as described hereinbefore in connection with step 380.

The numeral 388 of FIG. 7 denotes a step which is entitled PRINT TIME CODE and which corresponds to lines 5640 through 5820 of the program. During that step, the time data which is stored in RAM locations HEX 2002 and HEX 2003 will be loaded into the print buffer, and then the sub-routine of FIGS. 11-13 will execute the printing of that line.

The numeral 390 of FIG. 7 denotes an X20 connective; and it will cause the program to branch, via a similarly-identified connective 392 of FIG. 8, to a further CALL STOP sub-routine 394 which corresponds to line 5860 of the program. That sub-routine will be identical in function and operation to the CALL STOP sub-routine of steps 380 and 386. Step 396 denotes a further CALL PRTLN sub-routine which corresponds to line 5890 of the program; and that sub-routine will be identical to the sub-routine 378 of FIG. 7. The numeral 398 of FIG. 8 denotes a further CALL STOP sub-routine which corresponds to line 5930 of the program; and that sub-routine will be identical to the sub-routines 380, 386 and 394.

The numeral 400 denotes a step which is entitled PRINT NON-RESETTABLE TOTAL MONEY and which corresponds to lines 5980 through 6230 of the program. During that step, the data in RAM locations HEX 2004 and HEX 2005 will be read, will be converted from numeric counts to dollar and cents values, will be converted into ASCII representations, will be loaded into the print buffer, and then will be printed by the sub-routine of FIGS. 11-13. At the conclusion of that sub-routine the print buffer will again be loaded with HEX 20 ASCII characters. The numeral 402 of FIG. 8 denotes a further CALL STOP sub-routine which corresponds to line 6270 of the program; and that sub-routine will be identical to similarly-numbered sub-routines 380, 386, 394 and 398.

The numeral 404 denotes a step which is entitled PRINT RESETTABLE TOTAL MONEY and which corresponds to lines 6310 through 6540 of the program. During that step, the data in RAM locations HEX 2006 and 2007 will be read, will be converted from numeric counts to dollars and cents values, will be converted into ASCII representations, will be loaded into the print buffer, and then will be printed by the sub-routine of FIGS. 11-13. At the conclusion of that sub-routine, the print buffer will again be loaded with HEX 20 ASCII characters. The numeral 406 denotes another CALL STOP sub-routine and it corresponds to line 6580 of the program. That sub-routine will be identical to the CALL STOP sub-routines 380, 386, 394, 398 and 402.

The numeral 408 denotes an X30 connective which causes the program to branch, via identically-identified connective 410 of FIG. 9, to another CALL PRTLN sub-routine 412 that corresponds to line 6600 of the program. That sub-routine will be the same as the sub-routines 378 and 396. The numeral 414 denotes a step which is entitled PRINT POWER FAIL and which corresponds to lines 6640 through 6890 of the program. During that step, the data in RAM location HEX 200A will be read, will be converted to its ASCII representation, will be loaded into the print buffer, and then will be printed by the sub-routine of FIGS. 11-13. At the conclusion of that sub-routine the print buffer will again be loaded with HEX 20 ASCII characters.

The numeral 416 denotes a step which is entitled PRINT HEADER and which corresponds to lines 6940 through 7320 of the program. During that step, the program will load into the print buffer, in ASCII representation form, the various letters and symbols constituting the header, will execute the sub-routine of FIGS. 11-13 to print that header, and then will load HEX 20 ASCII characters into that print buffer. The numeral 418 denotes a step which is entitled INIT SEL AND MAXIT and which corresponds to lines 7380 through 7470 of the program.

It will be noted that each time the RAM locations are cleared of re-settable totals, the MAXIT location in the RAM will be set to zero (0). The next time the conductor 92 receives a serial bit stream, the selection line number which is represented by that serial bit stream will be determined and will be stored in the MAXIT location. During each succeeding time the conductor 92 receives a serial bit stream, the selection line number represented by that serial bit stream will be determined and will be stored in the MAXIT location—if it is higher than the previously-stored selection line number. If the selection line number represented by that serial bit stream equals or is smaller than the selection line number which is stored in the MAXIT register, the stored number will be left unchanged. In this way, the number which is stored in that register will quickly be incremented until it equals the total number of active selection switches of the vending machine.

Whenever a command to print is developed—as in the routine of FIGS. 11-13—the program will read the number in the MAXIT location and store it in scratch pad register 38. Also, the data in scratch pad register 39, which corresponds to the selection line number, will be set to zero (0). Thereafter, the program will cause the printer 136 to print on the printout only that number of horizontal rows of selection line data which equals the number that is stored in the MAXIT location—and which represents the highest-numbered active selection switch of the vending machine. This is very desirable; because it will enable the printer 136 to stop printing lines on the printout when it reaches the highest-numbered selection line for which any data has been sensed and stored since the last time an inventory function was performed. As a result, the printing operation will be kept as short as practical. Also the printout will not have a long blank area at the end thereof which would correspond to that portion of the thirty-two (32) selection line capacity of the data acquisition unit which was not used by the vending machine.

Step 420 of FIG. 9 is entitled PRINT SELECTION DATA and it corresponds to lines 7500 through 8920 of the program. That step will cause the sub-routine of FIGS. 11-13 to be executed; and, during that sub-routine, the data—which relates to selection line one and which is to be printed on the printout as a data line—will be converted to dot form, will be given ASCII representation, will be loaded into the print buffer, and then be printed onto the printout. That data consists of the selection line number, the number of products vended during vending operations (other than "free vends") initiated by the first selection switch since the last inventory function, the total number of products vended during vending operations (other than "free vends") initiated by the first selection, and the total of the prices of all products vended during vending operations (other than "free vends") initiated by the first selection switch.

The numeral 422 denotes a step which is entitled DECREMENT MAXIT and which corresponds to line 8300 of the program. During that step, the number in scratch pad register 38 will be decremented by one (1). The numeral 424 denotes a step which is entitled MAXIT=0? and which corresponds to line 8310 of the program; and the comparing function of that step will determine whether the number in scratch pad register 38 is zero (0). If a NO is produced by that function, the program will loop to step 420 where the data in the next higher selection number will be read from the RAM location, will be converted to ASCII representation, will be loaded into the print buffer, and then will be printed by the sub-routine of FIGS. 11-13. At the conclusion of that sub-routine, the print buffer will again be loaded with HEX 20 ASCII characters. Also, the data in scratch pad register 39 will be incremented, so the next execution of step 420 will address a still-higher numbered selection line. During the succeeding execution of step 422, the number in scratch pad register 38 will again be decremented; and, during the succeeding execution of step 424, a further comparing function will determine whether the data in scratch pad register 38 is zero (0). If a further NO is provided, the program will loop through steps 420, 422 and 424—with successive reading of the data corresponding to progressively-higher selection numbers, with conversions of that data to ASCII representation, and with printing of that data until the number in scratch pad register 38 is zero (0). At the conclusion of those loopings, the printer will respond to the resulting YES from step 424 to cause the program to execute step 426—which is entitled SET BUFFER CLEAR FLAG=TRUE and which corresponds to lines 8360 through 8380 of the program. During that step, the buffer clear flag will be set to "true" from its previously-set "false" state. Step 428 is entitled PRINT 5 BLANK LINES and it corresponds to lines 8440 through 8480 of the program. During that step, the PRTLN sub-routine of FIGS. 11-13 will be called and executed five (5) times. Because the print buffer will be loaded with HEX20 ASCII characters before each of those five (5) executions, and because it will be loaded with HEX 20 ASCII characters at the ends of those executions, five (5) blank lines will be provided on the printout during the advancing of that printout. The numeral 430 denotes a MODE connective which will branch the program, via connective 328 of FIG. 3 to step 310 and then to the routine of FIG. 4. Step 310 will again re-energize the relay coil 80 and thereby close the contacts **84** and **90** to apply a Line **6** signal to the coin changer **51**.

If a further printout is desired, it is only necessary to re-close the switch **138** of FIG. **1**. Thereupon, the hereinbefore-described routine of FIGS. **7–9** will be repeated to produce an exactly-identical printout; because none of the data of that printout has been cleared. By merely pressing the switch **138** of FIG. **1** as often as desired, any number of identical printouts can be attained—as long as no "non-free" vending operations have occurred. If any succeeding execution of step **316** of FIG. **4** provides a NO, the program will loop through the routine of FIG. **4** and step **310** of FIG. **3** until some further action is taken which will affect one or more of the steps through which the program will loop.

During each execution of step **324** of FIG. **4** wherein a YES is provided, the program will branch to, and execute, the routine of FIGS. **5** and **6**. During step **358** of FIG. **6**, a YES will be provided; because the buffer clear flag was set to "true" during step **426** of FIG. **9**. Thereafter, the rest of the routine of FIG. **6** will be executed before the program branches, via connectives **368** and **328**, respectively, of FIGS. **6** and **3**, to step **310** of FIG. **3**—with consequent looping through that step and the routine of FIG. **4**.

As pointed out hereinbefore, step **434** of FIG. **10** constitutes the CALL STOP sub-routine of steps **380**, **386**, **394**, **398**, **402** and **406**. STOP connective **432** will direct the program to that step; and MODE connective **436** will repeatedly branch the program back to step **310** of FIG. **3** until a NO is produced by the comparing function of step **434**—thereby indicating that switch **140** of FIG. **1** has been closed. When that NO is produced, RETURN connective **438** of FIG. **10**, which corresponds to line **8700** of the program, will cause that program to reenter that CALL STOP step which directed the program to the sub-routine of FIG. **10**.

It will be noted that the printing unit of the Olivetti Model PU1800/B/18 thermal printer can print only ten (10) dots at a time; and, in the preferred format of data on the printout, each horizontal row has one hundred (100) dot-accepting locations. The print of data in that number of dot-accepting locations is effected by (a) printing whatever dots are needed in the endmost odd-numbered ten (10) dot-accepting locations of the uppermost row of dots in a line of data during a first execution of step **462** of FIG. **12**, (b) printing whatever dots are needed in the ten (10) even-numbered dot-accepting locations immediately adjacent the previously-printed odd-numbered dots during a first execution of step **470** of FIG. **12**, and (c) alternating four additional executions of step **462** with four additional executions of step **470**. The resulting ten (10) printings will provide all of the dots which are needed in the uppermost row of dots in a line of data on the printout.

It also will be noted that the printing unit prints the uppermost row of dots of any data line by advancing in step-by-step fashion from right to left; and, further, that the printing unit will print the next-uppermost row of that data line by advancing in step-by-step fashion from left to right. As a result, the endmost odd-numbered dots will be adjacent the right-hand ends of some rows but will be adjacent the left-hand ends of other rows. However, in the printing of each row of dots, the printing unit will start at the leading edge of that row.

The paper, which will be used as part of the printout, is continually in engagement with the printing unit. Also that paper will move continuously relative to that printing unit. However, the movement of that paper relative to the thermal heads of that printing unit is slow enough, and those thermal heads heat and cool rapidly enough, so dots can be formed in a discrete and clear manner.

The microprocessor **50** has two EPROMS wherein the attached program is stored; and the locations wherein that program are stored are followed by locations where a dot pattern look-up table is stored. The data which is to be printed on the printout must be read, must be converted into a dot pattern by use of the dot pattern look-up table, and then must be stored in the print buffer. Thus, as indicated by FIGS. **11–13**, registers **2** and **6** must be initialized to zero (0) in step **442**, which is entitled INITIALIZE COUNTERS and which corresponds to lines **11560** through **11660** of the program. During step **444**—which is entitled SELECT PRINT POS. **1** DOTS and which corresponds to lines **1700** through **1214** of the program—the data, which relates to a selection line and which is to be printed on the printout as a data line, will be read, and then the dot pattern look-up table will provide corresponding dot pattern data. That data will be loaded into scratch pad registers **4** and **5**, and thereafter will be transferred to Ports **0** and **1** of microprocessor **50**. The thermal heads of the printing unit will be turned "off" in step **446**, which is entitled TURN PRINT HEAD OFF and which corresponds to lines **12180** through **12200** of the program. Those heads are turned "off" by causing the pins **0** through **7** of Port **0** and the pins **0** and **1** of Port **1** to apply "0"s to the inputs of inverter drivers **54**, **56**, **58**, **60**, **63**, **64**, **66**, **68**, **70** and **72**, respectively. The resulting logic "1"s at the outputs of those inverter drivers wil de-energize all of the thermal heads.

During step **448**, a comparing function will determine whether a bit has been set in register **6** to indicate that a printing step has been initiated. Because that register was initialized to zero (0) during step **442**, the comparing function of step **448** will provide a NO. Thereupon, step **450** will cause pin **7** of Port **5** of FIG. **2** to apply a "1" to the input of inverter driver **74**; and the consequent "0" at the input of Darlington amplifier **192** will cause a logic "1" to be applied to conductor **210** to start the motor of printer **136**. Also, a "0" at the input of Darlington amplifier **170** will cause an enabling "1" to be applied to the thermal heads of the printing unit of printer **136**. However, the signals at pins **0** through **7** of Port **0** and pins **1** and **2** of Port **1** will be keeping those thermal heads de-energized. During step **452** which is entitled PRINT START=1? and which corresponds to lines **12320** through **12346** of the program, a comparing function will determine whether the printer has applied a "start" to conductor **146**. If that function provides a NO, the program will loop at step **452** until that strobe is applied to that conductor. As soon as step **452** senses the application of that strobe, it will provide a YES; and then step **454**—which is entitled PRFLG=1 and which corresponds to lines **12350** through **12360** of the program—will set a bit in register **6** to indicate that a printing operation has been initiated. Thereafter the program will branch, via ST2 connectives **456** and **458**, respectively, of FIGS. **11** and **12** to step **460**, which is entitled STROBE P1=1? and which corresponds to lines **12380** through **12400**. If the printer has applied strobe P1 to conductor **148**—to indicate that the printing unit has moved into position to print the endmost odd-numbered dots of the uppermost row of a line of data, the comparing function of step **460** will provide a YES. If a NO is provided, the program will loop at step **460** until the P1 strobe is developed.

During step **462**—which is entitled OUTPUT P1 DOTS and which corresponds to lines **12420** through **12780**—pins **0** through **7** of Port **0** and pins **1** and **2** of Port **1** will apply logic states to the inputs of the adjacent inverter drivers to cause energizing "0"s to appear at the inputs of those thermal heads which are intended to form dots during the printing step. While step **462** is being executed, step **464** will be initiated; because step **462** takes a finite time to execute. Step **464** is entitled SELECT P2 DOTS and it corresponds to lines **12830** through **13270** of the program. During that step, the dot pattern for the topmost even-numbered dots which are immediately adjacent the just-printed endmost odd-numbered dots will be determined from the dot pattern look-up table; and then the resulting data will be stored in scratch pad registers **4** and **5** and subsequently applied to the Ports **0** and **1** of microprocessor **50**. At the conclusion of the printing operation of step **462**, the data in dot register **2** will be incremented by a one (1). Also, step **466**—which is entitled TURN PRINT HEAD OFF and which corresponds to lines **13310** through **13330** of the program—will de-energize all of the thermal heads—in the same manner in which those thermal heads were de-energized during step **446** of FIG. **11**.

During step **468**—which is entitled STROBE P2=1? and which corresponds to lines **13350** through **13370** of the program—a comparing function will determine whether the P2 strobe has been applied to conductor **152**. That strobe will be applied when the printing unit is in position to print the endmost even-numbered dots. If the comparing function of step **468** provides a NO, the program will loop at that step until the P2 strobe is applied. Thereupon, step **470**—which is entitled OUTPUT P2 DOTS and which corresponds to lines **13390** through **13780** of the program—will be executed. During that step appropriate signals will be applied to the pins of Ports **0** and **1** of microprocessor **50** to effect the heating and de-energization of appropriate ones of the thermal heads; and thereby effect the printing of the endmost, even-numbered dots in the topmost row of the line of data. Before the conclusion of step **470**, the number in the dot register **2** will be incremented. Step **472** which is entitled END OF LINE? and which corresponds to lines **13820** through **13860** of the program, will determine whether an entire line of data has been printed on the printout. Specifically, the two (2) in dot register **2**—which represents a single execution of each of steps **462** and **470**—will be compared with the number seventy (70), and will provide a NO. Thereupon, the program will branch, via SEL1 connective **474** of FIG. **12** and the identically-identified connective **476** of FIG. **11**, to step **444** of FIG. **12**. During that step the dot pattern look-up table will be read to determine the dot pattern for the data for the next odd-numbered dot-accepting locations, and then, during step **446**, the printing elements will again be turned "off". During step **448**, the comparing function will provide a YES; and hence the program will branch to ST2 connective **456**—and thence via ST2 connective **458** of FIG. **12** to step **460**. During step **472** of FIG. **12** the print motor will be turned off as a result, and during step **450** of FIG. **11**, the motor will be turned on, to start the next line of printing.

The program will execute step **460** and the rest of the routine of FIG. **12**; and, in doing so, will print two further groups of dots for the uppermost row of the line of data, and also will increment dot register **2** twice. Consequently, the comparing function of step **472** will provide a further NO, and a further looping of the program to step **444** of FIG. **11**. The printer **136** will require a total of five (5) executions of the routine of FIGS. **11** and **12** to provide five (5) printings of odd-numbered dots. However, when the fifth execution of those routines is complete, the count in dot register **2** will be ten (10) and the printing unit will have automatically indexed itself into register with the second uppermost row of dots.

The ten (10) printing operations for the uppermost row of dots will be followed by ten (10) further printing operations to print the second uppermost row. Because each of the characters that are used in printing the printout consists of seven (7) vertically-spaced horizontal rows, the printing of one full line of data requires a total of thirty-five (35) loopings through the routine of FIGS. **11** and **12**. During each looping, the number stored in dot register **2** will be incremented twice; and hence, at the end of the thirty-five loopings, step **472** will determine that the count in that register equals the seventy (70) which was loaded into that register during step **302**. Thereupon, the program will respond to the YES of step **472** to branch, via SPACE connective **478** and identically-named connective **480** of FIG. **13** to step **482**, which is entitled WAIT 2.4 MS FOR PRINT HEAD and which corresponds to lines **13900** through **13950** of the program.

During that step, any further movement of the program will be delayed for a time period which corresponds to the normal delay that is involved in selecting the dot pattern for a next group of dots. During step **484**, which is entitled TURN PRINT HEAD OFF and which corresponds to lines **13970** through **13990** of the program, the same operation is performed that was performed in steps **446** and **466**, namely, the de-energizing of the thermal heads of the printing unit. Step **486**, which is entitled STROBE P1=1? and which corresponds to lines **14010** through **14030**, will determine whether the P1 strobe is being applied to conductor **148** by printer **136**. If the answer is NO, the program will loop at step **486** until that strobe is applied. When that strobe is applied, step **488**—which is entitled INCREMENT DOT COUNTER and which corresponds to lines **14070** through **14090**—will be indicated. During that step, the data in dot register **2** will be incremented to seventy-one (71). During step **490**—which is entitled STROBE P2=1? and which corresponds to lines **14130** through **14150** of the program—will determine whether printer **136** is applying the **P2** strobe on conductor **150**. If the answer is NO, the program will loop at step **490** until that strobe is applied. Step **492**—which is entitled INCREMENT DOT COUNTER and which corresponds to lines **14190** through **14210** of the program—will increment the count in dot register **2** to seventy-two (72). During step **494**—which is entitled DOTS 90? and which corresponds to lines **14230** through **14240** of the program—the count in dot register **2** will be checked to determine whether it equals ninety (90). If the answer is NO, the program will loop through steps **486**, **488**, **490**, **492** and **494** until the answer is YES. During the twenty (20) increments of the count in dot register **2**—after the conclusion of step **472** of FIG. **12**, the printing head will move vertically downwardly a distance equal to the combined heights of two rows of dots. The thermal heads were left de-energized, and hence a blank space was created between the previously-printed line of data and the next-succeeding line of data. Step **496** is entitled TURN MOTOR OFF and it corresponds to lines **14280** through **14290** of the program; and, during that step, the state of pin **7** of Port **5** will be changed to render the Darlington amplifiers **170** and **192** conductive. Thereupon, the motor will be de-energized, and hence will permit the printing unit to come to rest.

The program will then branch, via CLEAR connective **498** and identically-named connective **500** of FIG. **14**, to step **502**, which is entitled CNT=20 and which corresponds to lines **14330** through **14340** of the program. During that step, the dot register 0 will have data loaded into it which corresponds to the number twenty (20). The numeral **504** denotes a step entitled CALCULATE ISAR ADDRESS and which corresponds to lines **14350** through **14370** of the program. During that step, the base address of fifteen (15) is added to the count of twenty (20)—which was established in register **0** during step **502**—to provide the count of thirty-five (35). That count will enable the ISAR to address register **35** which is the highest-number register of the print buffer. The numeral **506** denotes a step which is entitled SAVE A SPACE AT ADDRESS and which corresponds to lines **14380** through **14390** of the program. During that step, the ASCII representation HEX 20—which corresponds to a blank space—will be loaded into the ISAR. Step **508** is entitled DECREMENT CNT, and it corresponds to line **14400** of the program; and, during that step, the count in register **0** will be decremented by one (1). During step **510**, which is entitled CNT=0? and which corresponds to line **14410** of the program, a comparing function will determine whether the count in register **0** has been decremented to zero (0). If the answer provided by that function is NO, the program will loop through steps **504, 506, 508** and **510** until that function provides a YES. At that time, the ISAR will address the first register which is part of the print buffer; and that register will have been loaded with space-indicating HEX 20's. The program will then, via connective **512**—which is entitled RETURN and which corresponds to line **14420** of the program—cause the program to return to the particular step which initiated the sub-routine of FIGS. **11-13**.

During the sub-routine of FIG. **7**, the execution of step **378** will branch the program to the sub-routine of FIGS. **11-13**. Similarly, during executions of the routines of FIGS. **8** and **9**, the executions of steps **396** and **412** will branch the program to the sub-routine of FIGS. **11-13**. However, because HEX 20 is loaded into the print buffer at the end of each printing operation, and because the PRTLN sub-routines will not load any data into that buffer, that buffer will not have any data in which it could effect the printing of data on the print-out. Consequently, although the various steps of the routine of FIGS. **11-13** would be executed, and although the routine of FIG. **14** would be executed; all of the thermal heads of the printing unit would remain de-energized. Consequently, each execution of a PRTLN sub-routine will provide a full seven row high blank space on the face of the print-out.

The operation of the sub-routine of FIGS. **11-13** is longer when it is initiated by step **420** than it is when it is initiated by any of steps **378, 382, 384, 388, 396, 400, 404, 412, 414, 416** and **428**; because step **420** requires a full line of data for each selection line. However, the execution of the sub-routine of FIGS. **11-13** for steps **382, 384, 388, 400, 404, 414** and **416** will, except for the shorter time required, be essentially the same as that described hereinbefore in connection with step **420**. In the case of steps **378, 396, 412** and **428**, the execution of the sub-routine of FIGS. **11-13** is different from that of step **420**. Specifically, steps **378, 396, 412** and **428** do not supply power to the thermal heads of the printer **136**; and hence the execution of the sub-routine of FIGS. **11-13** will, during those steps, provide blank spaces on the printout.

It will be noted that the relay coil **80** must be energized to maintain the contacts **90** and **84** in engagement. Further, it will be noted that unless those contacts are maintained in engagement, the vending machine **51** will be unable to accept coins. This is significant; because it will keep persons from removing the line cord of the data acquisition unit from the socket therefor in an effort to decrease the number of vends which would be recorded on the next printout. Further, any separation of the plug and socket **33** from each other also would keep the coin changer **51** from accepting coins. The combination of relay coil **80** and the running count of power outages will minimize the likelihood of "cheating" by manipulation of line cores, sockets, fuses or the like.

It will be noted that the price data which is supplied to the printer **136** is the exact data that is generated by the vending machine during vending operations. When changes are made in the prices that are set in the vending machine, the data which is supplied to the data acquisition unit and the data which that data acquisition unit will supply to the printer, will automatically and fully reflect those changes.

It will be noted that the sub-routine of FIG. **14** is automatically addressed by the program at the end of the sub-routine of FIGS. **11-13**. However, the former sub-routine also can be addressed directly by step **376** of FIG. **7**. At the conclusion of the sub-routine of FIG. **14**, the program will return to the particular step which called it; and, in the case where that sub-routine immediately follows the subroutine of FIGS. **11-13**, it will return to the step which called the sub-routine of FIGS. **11-13**.

A considerable number of the steps of the flow chart are dedicated to the operation of the Olivetti printer. Because that printer is a commercially-available device, and because it always requires a program to enable it to operate, some portions of the program are not, per se, parts of the present invention. Instead, those parts merely illustrate the printing function that is performed by the printer **136**. Commercially-available programs are offered to purchasers of the Olivetti printer; but the steps of the attached program are desired, because they are tailored to the printout format disclosed herein.

Referring particularly to FIG. **15**, the numeral **550** denotes a NOR gate which has the output of opto-coupler **100** of FIG. **1** connected to one input thereof. The output of that NOR gate is connected to a binary counter **552** which preferably consists of four **7497** binary counters. The output of that counter is connected to the address lines of a data RAM **554** which preferably consists of four **5101** CMOS RAMS. The output of that RAM is connected to the B inputs of an adder **556** which preferably is eight **7483** adders. The output of that adder is connected, via a latch **558**, to the Data In inputs of RAM **554**. That latch preferably is two 74LS273 octal latches. The data outputs of that RAM also are connected to a Binary-BCD converter **560** which preferably will be four 74185 Binary-BCD converters. The output of that converter is connected to a multiplexer **562** which preferably is four 74LS153 multiplexers. The output of that multiplexer is connected to the address inputs of a ASCII pattern look-up PROM **564**, which preferably is a **2708** EPROM. A printer controller **566**, which preferably is a CY-**480** UPC of Cybernetic Micro Systems, will receive data from the PROM **564** and will supply data to a printer interface **568**, which preferably will consist of all of the components of FIGS. **1** and **2** that are (a) connected to pins **0** through **7** of Port **0**, to pins **0**, **1**, **6** and **7** of Port **4**, and to pins **0–3** and **6** of Port **5** and (b) located to the left of plug and socket **114** in FIGS. **1** and **2**. Instead of being connected to those pins, the printer interface will be connected to the printer controller **566**. The numeral **136** denotes a printer which preferably is identical to the similarly-numbered printer of FIGS. **1** and **2**.

The numerals **138** and **140** denote switches which preferably are identical to the similarly-numbered switches of FIG. **1**. The numeral **570** denotes a switch logic block which preferably consists of two **7400** and two **7402** gates; and switches **138** and **140** are connected to inputs of that block. One output of that switch logic block is connected to an input of a NAND gate **572**; and an oscillator **574**—of standard and usual design which develops a frequency of essentially two kilohertz (2 KHz)—is connected to the other input of that NAND gate. The output of that NAND gate is connected to a control state counter **576** which preferably consists of two **7497** binary counters. The other output of switch logic block **570** is connected to the re-set input of counter **576**. The output of that counter is connected to a dual octal ten inputs AND/OR gate array **578**; and a MMI PAL 10H8 gate array is preferred. One output of that gate array is connected to switch logic block **570**; and two further outputs of that gate array are connected to printer controller **566**. Lines corresponding to the three least significant bits extend from the gate array **578** to address inputs of the PROM **564**. A further output of that gate array extends to the Binary BCD converter **560**; and still another output of that gate array extends to a binary counter **580** which preferably consists of four **7497** binary counters. The clock input of that counter receives inputs from conductor **94** and opto coupler **96**—each of which preferably is identical to the similarly-numbered conductor and opto coupler of FIG. **1**. The output of counter **580** extends to the A inputs of adder **556**; and a line corresponding to the least significant bit extends to gate array **578**. A further output of that gate array extends to a relay circuit **582** which preferably includes the diode **52**, resistor **78**, relay coil **80**, flyback diode **82** and relay contacts **8** and **90** of FIG. **1**. Yet another output of the gate array **578** extends to the read/write input of data RAM **554**. A still further output of that gate array extends to the re-set input of binary counter **552**. A carry output of that counter is connected to an input of that gate array. Yet another output of that gate array is connected to the other input of NOR gate **550**. Still another output of the gate array extends to the CLEAR input of latch **558**; and conductor **31** of FIG. **1** extends to the set input of that latch. The numeral **584** denotes a power supply which is connectable to a source of one hundred and fifteen volts A.C. and which supplies regulated plus five (+5) volts and regulated plus twenty-four (+24) volts.

The circuit of FIG. **15** constitutes a hardware equivalent of the control device disclosed by FIGS. **1** through **14**. Because of the low cost, simplicity and flexiblity of the control device of FIGS. **1–14**, it is the preferred embodiment of the present invention.

The opto-coupler **100** will respond to a serial bit stream on conductor **92** from the coin changer **51** of FIG. **1** to apply a corresponding serial bit stream to the left-hand input of NOR gate **550**; and the output of that NOR gate will be a corresponding, but inverted, serial bit stream that will be supplied to the clocking input of counter **552**. That counter will count the number of bits in that serial bit stream and will use that count as the address of the data in the data RAM **554**. During the succeeding serial bit stream on conductor **94** from coin changer **51**, the opto-coupler **96** will apply a corresponding serial bit stream to binary counter **580**. That counter will count the number of bits, and then will supply them to adder **556**, while also supplying the least significant bit to the gate array **578**. The RAM **554** will supply data to the B inputs of the adder **556**; and the gate array **578** will apply appropriate signals to the read-write input of the RAM to enable the data which is outputed by the adder **556**—and momentarily stored in the latch **558**—to be re-written into the appropriate addresses in that RAM. This provides an accumulation of the total number of bits—each of which represents five cents (5¢)—that were supplied in the serial bit stream on conductor **94**. The oscillator **574** constitutes a "clock" for the circuit of FIG. **15**; and it will act, through NAND gate **572**, to supply signals to the control state counter **576**. The output of that counter will enable the gate array **578** to apply signals to the NOR gate **550** to permit the counter **552** to provide further addresses in the data RAM which will then be addressed. This enables the circuit to clear the data and also to output the data via Binary-BCD converter **560** and multiplexer **562** to the ASCII pattern look-up PROM **564**. The printer controller **566** will respond to the data from that PROM, and also to signals from the gate array **578**, to appropriately cause the printer interface **568** and the printer **136** to print characters in the form of dots on a printout sheet in the manner in which the corresponding printer interface and printer of FIGS. **1** and **2** print such a printout.

The printer **136** will be started by closing the switch **138** in the manner described hereinbefore in connection with FIGS. **1** and **2**. Similarly, the stopping of the printer **136** will be effected by closure of switch **140** in the manner described hereinbefore in connection with FIG. **1**. In either event, the closing of a switch will cause switch logic block **570** to apply an appropriate signal to NAND gate **572**, and also to the re-set input of control state counter **576**. The relay circuit **582** will energize the relay coil **80** and thereby effect the closing of contacts **84** and **90** whenever the printer **136** is not operating and power is on.

Whereas the drawing and accompanying description have shown and described two embodiments of the present invention, it should be apparent to those skilled in the art that various changes may be made in the form of the invention without affecting the scope thereof.

```
F8X V05.1
 TOTALVEND PRINT4 1.0 3/25/79 BRH
        *  TOTALVEND INVENTORY CONTROL SYSTEM
        *
        *  FILE NAME:  PRINT4
                 TITLE TOTALVEND PRINT4 1.0 3/25/79 BRH
        *
                 PUNCH ON
        *
        * PORT ASSIGNMENTS
        *
        * P0-0 PRINTER THERMAL ELEMENTS
        * TO
        * P0-7
        * TO
        * P1-0,P1-1 THERMAL ELEMENTS
        * P1-6, P1-7 INPUTS DIP SWITCHES
        * P4-0 STRT PRINTER TIMING
        * P4-1 P1 TIMING
        * P4-2 P2 TIMING
        * P4-3 TOT
        * P4-4 SEL
        * P4-5 PRINT SWITCH
        * P4-6 STOP PRINT SWITCH
        * P4-7 ERASE CMOS RAM SWITCH
        * P5-0,1,2,3 OUTPUTS DIP SW.
        * P5-6 RELAY
        * P5-7 PRINTER MOTOR
        *
        *
        *
        *  GLOBAL DECLARATIONS
        *
        CNT      EQU   0              COUNTER FOR CLEAR ROUTINE
        CNT1     EQU   3
        CNT2     EQU   4
        CNT3     EQU   5
        DIR      EQU   0              DIRECTION FLAG
        LINE     EQU   1              LINE MASK
        DOT      EQU   2              DOT COUNTER
        ROW      EQU   3              ROW COUNTER
        STOR1    EQU   4              DOT STORAGE LSB
        STOR2    EQU   5              DOT STORAGE MSB
        PRFLG    EQU   6              PRINT FLAG
        CHR      EQU   7              CHARACTER COUNTER
        TEMP     EQU   8              TEMPORARY BUFFER STORAGE
        *
        BUFAD    EQU   O'70'          ASCII CONV. BUFFER START
        BUFP     EQU   38
        ADDR     EQU   O'20'          ISAR-1 BUFFER ADDRESS
        PTOT     EQU   4
        MTOT     EQU   8
        PMOT     EQU   5              MOTOR PORT
        MOTON    EQU   H'C0'          MOTOR ON BYTE
        MOTOF    EQU   H'40'          MOTOR OFF BYTE
        PDOTL    EQU   0              PORT LSB DOTS
        PDOTH    EQU   1              PORT MSB DOTS
        PORT     EQU   4              PORT INPUT SIGNALS
        MPSTRT   EQU   1              MASK PRINT START
        MSTP1    EQU   2              MASK STROBE P1
        MSTP2    EQU   4              MASK STROBE P2
        PMODE    EQU   4
        MMODE    EQU   H'20'
        PSEL     EQU   4
        MSEL     EQU   H'10'
        PSW      EQU   4
        MSTOP    EQU   H'40'
        HB       EQU   0
        MB       EQU   1
        LB       EQU   2
        HB1      EQU   3
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                     MB1       EQU   4
                     LB1       EQU   5
                     IDST      EQU   H'2000'        ID # STORAGE
                     TIMST     EQU   H'2002'        TIMECODE
                     MONTL     EQU   H'2004'        TOTAL MONEY NON-RESETTING
                     RMONTL    EQU   H'2007'        RESET MONEY TOTAL
                     PFAIL     EQU   H'200A'        POWER FAIL BYTE
                     MAXIT     EQU   H'200B'        MAX. ITEMS
                     PRTFL     EQU   H'200C'        PRTFL BUFFER CLEAR FLAG
                     STORE     EQU   H'200D'        START OF SEL. STORAGE
                     *
                     BUF1      EQU   O'21'
                     BUF2      EQU   O'24'
                     BUF3      EQU   O'30'
                     BUF4      EQU   O'36'
                     BUF5      EQU   O'40'
                     *
                     * END GLOBAL DECLARATIONS
                     *
                     *
                     *
0000 20 FF                     LI    H'FF'
0002 B0                        OUTS  0
0003 73                        LIS   3
0004 B1                        OUTS  1
0005 70                        CLR
0006 B4                        OUTS  4
0007 B5                        OUTS  5
                     *
                     *
                     *  INCREMENT POWER DOWN
0008 2A 20 0A                  DCI   PFAIL
000B 16                        LM
000C 2A 20 0A                  DCI   PFAIL
000F 1F                        INC
0010 17                        ST
                     *
                     * INIT BUFFER CLEAR FLAG
                     *
0011 2A 20 0C                  DCI   PRTFL
0014 70                        CLR
0015 17                        ST
                     *
                     *
0016 20 32                     LI    O'62'          INIT TIME BUFFER
0018 0B                        LR    IS,A
0019 20 CF                     LI    207
001B 5D                        LR    I,A
001C 73                        LIS   3
001D 5C                        LR    S,A
                     *
001E 70              MODE      CLR                  RELAY ON
001F B5                        OUTS  5
                     *
0020 A4                        INS   PORT           CHECK ERASE
0021 21 80                     NI    H'80'
0023 84 07                     BZ    MODE1
0025 28 01 AC                  PI    ERASE
0028 28 04 EC                  PI    PRTLN
                     *
002B A4              MODE1     INS   PMODE          CHECK PRINT SWITCH
002C 21 20                     NI    MMODE
002E 84 07                     BZ    A1             SKIP IF OFF
0030 20 40                     LI    H'40'          RELAY OFF
0032 B5                        OUTS  5
0033 29 01 C7                  JMP   DUMP           PRINT IT
0036 20 30           A1        LI    O'60'          TIME BUFFER
0038 0B                        LR    IS,A
0039 3D                        DS    I
003A 82 1F                     BC    A2
```

```
003C 3D                DS    I
003D 82 1C             BC    A2
003F 3C                DS    S
0040 82 19             BC    A2
0042 20 CF             LI    207
0044 5D                LR    I,A
0045 3C                DS    S
0046 82 13             BC    A2
0048 73                LIS   3
0049 5C                LR    S,A
004A 2A 20 02          DCI   TIMST
              *  INCREMENT TIME
004D 0E                LR    Q,DC
004E 16                LM
004F 51                LR    MB,A
0050 16                LM
0051 24 01             AI    1
0053 52                LR    LB,A
0054 41                LR    A,MB
0055 19                LNK
0056 0F                LR    DC,Q
0057 17                ST
0058 42                LR    A,LB
0059 17                ST
              *
005A A4       A2       INS   PSEL      LOOK FOR SEL TRANSITION
005B 21 10             NI    MSEL
005D 84 C0             BZ    MODE      LOOP BACK
              *
              * END OF MAIN LOOP
              *
005F 70                CLR
0060 50                LR    CNT,A
0061 53                LR    CNT1,A    CLEAR STORAGE
0062 A4       X1       INS   PSEL      LOOK AT SEL
0063 21 10             NI    MSEL
0065 84 08             BZ    X2        TRANSITION; BRANCH
0067 40                LR    A,CNT
0068 1F                INC
0069 50                LR    CNT,A
006A 84 B3             BZ    MODE      ERROR; SEL STUCK
006C 90 F5             BR    X1
              *
006E 40       X2       LR    A,CNT
006F 25 28             CI    40        CHECK FOR UNDER WIDTH
0071 92 06             BNC   X3        OK
0073 43                LR    A,CNT1
0074 21 FF             NI    H'FF'
0076 84 A7             BZ    MODE      NOISE; RETURN TO TOP
0078 70       X3       CLR
0079 50                LR    CNT,A     CLEAR STORAGE
007A A4       X4       INS   PSEL      LOOK FOR OPPOSITE TRANS
007B 21 10             NI    MSEL
007D 94 0A             BNZ   X5        TRANSITION; BRANCH
007F 40                LR    A,CNT     INC TIMER
0080 1F                INC
0081 50                LR    CNT,A
0082 25 48             CI    72        CHECK FOR RUN-OUT
0084 92 0A             BNC   X6        YES
0086 90 F3             BR    X4
0088 70       X5       CLR             CLEAR STORAGE
0089 50                LR    CNT,A
008A 43                LR    A,CNT1    INCR. DATA
008B 1F                INC
008C 53                LR    CNT1,A
008D 90 D4             BR    X1        LOOK FOR NEXT ONE
              *
008F 43       X6       LR    A,CNT1    LAST INCR
0090 1F                INC
0091 53                LR    CNT1,A
```

```
0092 70                   CLR                  END OF SEL PULSES; LOOK FOR
0093 50                   LR     CNT,A         TOT
0094 A4          X7       INS    PTOT
0095 21 08                NI     MTOT
0097 94 0B                BNZ    X8
0099 40                   LR     A,CNT
009A 1F                   INC
009B 50                   LR     CNT,A
009C 25 4B                CI     75            CHECK FOR RUN-OUT
009E 82 F5                BC     X7
00A0 29 00 1E XXXX        JMP    MODE          IGNORE; FREE VEND
                 *
00A3 70          X8       CLR                  CLEAR STORAGE
00A4 50                   LR     CNT,A
00A5 54                   LR     CNT2,A
00A6 55                   LR     CNT3,A
00A7 A4          X9       INS    PTOT
00A8 21 08                NI     MTOT          CHECK FOR TOT TRANS
00AA 84 0B                BZ     X11           YES; TRANSITION
00AC 35          X10      DS     CNT3          DELAY
00AD 94 FE                BNZ    X10
00AF 40                   LR     A,CNT
00B0 1F                   INC                  INCREMENT COUNTER
00B1 50                   LR     CNT,A
00B2 84 ED                BZ     XXXX          RUNOUT; LINE STUCK
00B4 90 F2                BR     X9            LOOK AGAIN
00B6 40          X11      LR     A,CNT
00B7 25 05                CI     5             CHECK FOR MINIMUM
00B9 92 06                BNC    X12           LONG ENOUGH
00BB 43                   LR     A,CNT1
00BC 21 FF                NI     H'FF'
00BE 84 D5                BZ     X7            NOISE
00C0 70          X12      CLR                  CLEAR STORAGE
00C1 50                   LR     CNT,A
00C2 A4          X13      INS    PTOT
00C3 21 08                NI     MTOT
00C5 94 0D                BNZ    X14           NEW TRANS DETECTED
00C7 35          X131     DS     CNT3
00C8 94 FE                BNZ    X131          WASTE TIME
00CA 40                   LR     A,CNT
00CB 1F                   INC
00CC 50                   LR     CNT,A
00CD 25 1E                CI     30
00CF 92 0A                BNC    X15           END OF PULSES DETECTED
00D1 90 F0                BR     X13           LOOK FOR TRANS
00D3 70          X14      CLR                  TRANS DETECTED
00D4 50                   LR     CNT,A
00D5 44                   LR     A,CNT2
00D6 1F                   INC
00D7 54                   LR     CNT2,A        INCREMENT DATA
00D8 90 CE                BR     X9            LOOK FOR ANOTHER PULSE
                 *
                 * DATA IS COLLECTED; NOW DO SOMETHING WITH IT
                 *
00DA 44          X15      LR     A,CNT2        LAST INCREMENT
00DB 1F                   INC
00DC 54                   LR     CNT2,A
00DD 43                   LR     A,CNT1        CHECK SEL # FOR VALID #
00DE 25 20                CI     32            MAX NO.
00E0 82 04                BC     X151          OK; SKIP
00E2 29 00 1E             JMP    MODE
                 *
00E5 2A 20 0C X151        DCI    PRTFL         CHECK BUFFER CLEAR FLAG
00E8 16                   LM
00E9 21 FF                NI     H'FF'
00EB 84 1F                BZ     X16           DON'T CLEAR
                 *
                 * CLEAR THE BUFFER
                 *
00ED 2A 20 07             DCI    RMONTL        CLEAR RESETTABLE MONEY TOTAL
```

```
00F0 70                 CLR
00F1 17                 ST
00F2 17                 ST
00F3 17                 ST
00F4 17                 ST                 CLEAR PFAIL
00F5 71                 LIS     1
00F6 17                 ST                 CLEAR MAXIT
               *
00F7 2A 20 0D           DCI     STORE
00FA 20 1E              LI      30
00FC 50                 LR      CNT,A
00FD 70                 CLR
00FE 17        CLBUF    ST
00FF 17                 ST
0100 76                 LIS     6
0101 8E                 ADC
0102 70                 CLR
0103 30                 DS      CNT
0104 94 F9              BNZ     CLBUF      CONTINUE UNTIL DONE
               *
0106 2A 20 0C           DCI     PRTFL      CLEAR FLAG
0109 70                 CLR
010A 17                 ST
               *
               *
010B 2A 20 04  X16      DCI     MONTL
010E 28 01 70           PI      ADD        ADD NICKELS TO MONTL
0111 28 01 70           PI      ADD        ADD NICKELS TO RMONTL
               *
0114 33                 DS      CNT1       INDEX = SEL-3
0115 33                 DS      CNT1
0116 2A 20 0B           DCI     MAXIT      CHECK MAX. ITEMS
0119 0E                 LR      Q,DC
011A 16                 LM
011B 25 00              CI      0
011D 84 09              BZ      X161
011F 18                 COM
0120 24 01              AI      1          FORM 2'S COMPLEMENT
0122 50                 LR      HB,A
0123 43                 LR      A,CNT1
0124 C0                 AS      HB
0125 92 04              BNC     X17        FORMER MAXIT LARGER; SKIP
0127 0F        X161     LR      DC,Q
0128 43                 LR      A,CNT1     GET NEW MAXIT
0129 17                 ST                 SAVE IT
               *
012A 33        X17      DS      CNT1
012B 2A 20 0D           DCI     STORE      BASE TO RAM
012E 43                 LR      A,CNT1
012F 13                 SL      1          X2
0130 13                 SL      1
0131 8E                 ADC
0132 8E                 ADC                INDEX*8+BASE=ADDRESS
0133 0E                 LR      Q,DC       SAVE DCO
0134 16                 LM
0135 51                 LR      MB,A
0136 16                 LM
0137 24 01              AI      1          ADD 1 TO IR
0139 52                 LR      LB,A
013A 41                 LR      A,MB
013B 19                 LNK                ADD CARRY
013C 51                 LR      MB,A
013D 0F                 LR      DC,Q       RESET DCO
013E 41                 LR      A,MB
013F 17                 ST
0140 42                 LR      A,LB       REPLACE IR
0141 17                 ST
0142 0E                 LR      Q,DC       SAVE DCO
0143 16                 LM                 GET INR
0144 50                 LR      HB,A
```

```
3500 0145 16               LM
3510 0146 51               LR     MB,A
3520 0147 16               LM
3530 0148 24 01            AI     1              ADD 1 VEND
3540 014A 52               LR     LB,A
3550 014B 41               LR     A,MB
3560 014C 19               LNK
3570 014D 51               LR     MB,A
3580 014E 40               LR     A,HB
3590 014F 19               LNK
3600 0150 50               LR     HB,A
3610 0151 25 01            CI     1              CHECK FOR OVERFLOW
3620 0153 94 0F            BNZ    REPX           OK; REPXACE DATA
3630 0155 41               LR     A,MB           CHECK MB
3640 0156 25 86            CI     H'86'
3650 0158 94 0A            BNZ    REPX           OK; REPXACE DATA
3660 015A 42               LR     A,LB
3670 015B 25 9F            CI     H'9F'
3680 015D 82 05            BC     REPX
3690 015F 70               CLR                   OVERFLOW; CLEAR
3700 0160 52               LR     LB,A
3710 0161 51               LR     MB,A
3720 0162 50               LR     HB,A
3730 0163 0F         REPX  LR     DC,Q           RESET DCO
3740 0164 40               LR     A,HB
3750 0165 17               ST
3760 0166 41               LR     A,MB
3770 0167 17               ST
3780 0168 42               LR     A,LB
3790 0169 17               ST
3800                 *
3810 016A 28 01 70         PI     ADD            ADD NICKELS TO $NR
3820                 *
3830                 *
3840                 * END OF SAVE ROUTINE
3850                 *
3860 016D 29 00 1E         JMP    MODE           RETURN TO MAIN LOOP
3870                 *
3880 0170 0E         ADD   LR     Q,DC           SAVE DCO
3890 0171 16               LM                    GET VAL
3900 0172 50               LR     HB,A
3910 0173 16               LM
3920 0174 51               LR     MB,A
3930 0175 16               LM
3940 0176 C4               AS     CNT2           ADD NICKELS
3950 0177 52               LR     LB,A
3960 0178 41               LR     A,MB
3970 0179 19               LNK
3980 017A 51               LR     MB,A
3990 017B 40               LR     A,HB
4000 017C 19               LNK
4010 017D 50               LR     HB,A
4020 017E 25 03            CI     3              CHECK FOR OVERFLOW
4030 0180 92 15            BNC    OVER           OVERFLOW
4040 0182 84 03            BZ     CK3            CHECK NEXT DIGIT
4050 0184 90 1F            BR     RPL1           REPLACE DATA
4060 0186 41         CK3   LR     A,MB           CHECK MB
4070 0187 25 0D            CI     H'0D'
4080 0189 92 0C            BNC    OVER
4090 018B 84 03            BZ     CK4            EQUAL; CHECK NEXT DIGIT
4100 018D 90 16            BR     RPL1           REPLACE DATA
4110 018F 42         CK4   LR     A,LB           CHECK LB
4120 0190 25 3F            CI     H'3F'
4130 0192 92 03            BNC    OVER
4140 0194 90 0F            BR     RPL1           EQUAL OR LESS, OK REPLACE
4150 0196 42         OVER  LR     A,LB           SUBTRACT 200000
4160 0197 24 C0            AI     H'C0'
4170 0199 52               LR     LB,A
4180 019A 41               LR     A,MB
4190 019B 19               LNK
```

```
019C 24 F2                AI    H'F2'
019E 51                   LR    MB,A
019F 40                   LR    A,HB
01A0 19                   LNK
01A1 24 FC                AI    H'FC'
01A3 50                   LR    HB,A
01A4 0F         RPL1      LR    DC,Q       RESET DCO
01A5 40                   LR    A,HB
01A6 17                   ST
01A7 41                   LR    A,MB
01A8 17                   ST
01A9 42                   LR    A,LB
01AA 17                   ST
01AB 1C                   POP              END OF SUBROUTINE
                *
                * ERASE ROUTINE
                *
01AC 70         ERASE     CLR              CLEAR COUNTER
01AD 50                   LR    CNT,A
01AE A4         ER1       INS   PORT
01AF 21 80                NI    H'80'
01B1 94 04                BNZ   ER2
01B3 29 00 1E             JMP   MODE
01B6 30         ER2       DS    CNT
01B7 94 F6                BNZ   ER1
01B9 2A 20 00 ]           DCI   IDST
01BC 70                   CLR
01BD 17         ER3       ST               ERASE BUFFER
01BE 30                   DS    CNT
01BF 94 FD                BNZ   ER3
01C1 2A 20 0B             DCI   MAXIT
01C4 71                   LIS   1
01C5 17                   ST
01C6 1C                   POP
                *
                *
                * START OF PRINT ROUTINE
                *
                *
01C7 28 06 0B   DUMP      PI    CLEAR      CLEAR BUFFER
                *
                *
                *
                * PRINT 1 BLANK LINE
                *
01CA 28 04 EC             PI    PRTLN
01CD 28 03 D6             PI    STOP
                *
                * PRINT HEADER
                *
01D0 20 12                LI    O'22'
01D2 50                   LR    CNT,A
01D3 40         H1        LR    A,CNT
01D4 0B                   LR    IS,A
01D5 20 2A                LI    C'*'
01D7 5C                   LR    S,A
01D8 40                   LR    A,CNT
01D9 1F                   INC
01DA 50                   LR    CNT,A
01DB 25 23                CI    O'43'
01DD 82 F5                BC    H1
01DF 28 04 EC             PI    PRTLN
01E2 20 12                LI    O'22'
01E4 50                   LR    CNT,A
01E5 2A 07 59             DCI   HBUF1
01E8 28 04 00             PI    HD1
01EB 28 04 EC             PI    PRTLN
01EE 28 03 D6             PI    STOP
01F1 28 04 EC             PI    PRTLN
01F4 20 13                LI    O'23'
```

```
01F6 50                 LR    CNT,A
01F7 2A 07 6C           DCI   HBUF2
01FA 28 04 00           PI    HD1
01FD 28 04 EC           PI    PRTLN
0200 20 17              LI    D'27'
0202 50                 LR    CNT,A
0203 2A 07 7D           DCI   HBUF3
0206 28 04 00           PI    HD1
0209 28 04 EC           PI    PRTLN
020C 28 04 EC           PI    PRTLN
020F 28 03 D6           PI    STOP
               *
               * PRINT ID #
               *
0212 70        READ     CLR              CLEAR STORAGE
0213 50                 LR    HB,A
0214 51                 LR    MB,A
0215 52                 LR    LB,A
0216 73                 LIS   3          INIT PORT
0217 B1                 OUTS  1
0218 77                 LIS   7
0219 55                 LR    CNT3,A     SET COUNTER
021A 45        X0       LR    A,CNT3
021B 18                 COM
021C B5                 OUTS  5
021D A1                 INS   1
021E 21 40              NI    H'40'      MASK FOR PA-6
0220 84 05              BZ    XA
0222 20 80              LI    H'80'
0224 C1                 AS    MB       ADD A 1
0225 51                 LR    MB,A     SAVE RESULT
0226 A1        XA       INS   1
0227 21 80              NI    H'80'      MASK FOR PA-5
0229 84 05              BZ    XB
022B 20 80              LI    H'80'
022D C2                 AS    LB
022E 52                 LR    LB,A     SAVE
022F 35        XB       DS    CNT3
0230 92 09              BNC   XC
0232 41                 LR    A,MB
0233 12                 SR    1
0234 51                 LR    MB,A     SAVE SHIFTED RESULT
0235 42                 LR    A,LB
0236 12                 SR    1          SHIFT
0237 52                 LR    LB,A      SAVE
0238 90 E1              BR    X0         RETURN & CONTINUE
               *
023A 28 04 34  XC       PI    ASCII      CONVERT IT
               *
               * LOAD BUFFER FOR PRINTING
               *
023D 20 11              LI    ADDR+1
023F 0B                 LR    IS,A
0240 20 49              LI    C'I'       ID #
0242 5D                 LR    I,A
0243 20 44              LI    C'D'
0245 5D                 LR    I,A
0246 4D                 LR    A,I        INCREMENT ISAR
0247 20 23              LI    C'#'
0249 5D                 LR    I,A
024A 20 39              LI    BUFAD+1    ASCII OUTPUT BUFFER
024C 0B                 LR    IS,A
024D 75                 LIS   5          INIT COUNTER
024E 50                 LR    CNT,A
024F 28 03 E6           PI    LDX2       SHIFT INTO PRINT BUFFER
               *
0252 28 04 EC           PI    PRTLN      PRINT THE LINE
               *
               * CHECK STOP
               *
```

```
0255 28 03 D6          PI    STOP
                 *
                 * PRINT TIMECODE
                 *
0258 2A 20 02          DCI   TIMST
025B 28 03 F5          PI    LOAD2
025E 28 04 34          PI    ASCII
                 *
                 * LOAD BUFFER FOR TIMECODE
                 *
0261 20 11             LI    ADDR+1
0263 0B                LR    IS,A
0264 20 54             LI    C'T'
0266 5D                LR    I,A            TC
0267 20 48             LI    C'H'
0269 5D                LR    I,A
026A 20 39             LI    BUFAD+1
026C 0B                LR    IS,A           ADDRESS ASCII BUFFER
026D 75                LIS   5
026E 50                LR    CNT,A
026F 28 03 E6          PI    LDX2           TRANSFER TO PRINT BUFFER
                 *
0272 28 04 EC          PI    PRTLN          PRINT IT
                 *
                 * CHECK STOP
                 *
0275 28 03 D6          PI    STOP
                 *
                 *
0278 28 04 EC          PI    PRTLN          PRINT EMPTY LINE
                 *
                 * CHECK STOP
                 *
027B 28 03 D6          PI    STOP
                 *
                 *
                 *  PRINT NON-RESET TOTAL MONEY
                 *
027E 2A 20 04          DCI   MONTL
0281 28 03 EE          PI    LOAD3
0284 28 04 10          PI    NICKL          CONVERT NICKELS TO ASCII
                 *
                 * LOAD PRINT BUFFER
                 *
0287 20 11             LI    ADDR+1
0289 0B                LR    IS,A
028A 20 54             LI    C'T'           T $
028C 5D                LR    I,A
028D 20 4E             LI    C'N'
028F 5D                LR    I,A
0290 20 52             LI    C'R'
0292 5D                LR    I,A
0293 4D                LR    A,I            SKIP SPACE
0294 4D                LR    A,I
0295 20 24             LI    C'$'
0297 5D                LR    I,A
0298 20 38             LI    BUFAD
029A 0B                LR    IS,A
029B 76                LIS   6
029C 50                LR    CNT,A
029D 28 03 E6          PI    LDX2           TRANSFER ASCII TO PRINT BUFFER
02A0 28 03 DC          PI    DP             ADD THE DECIMAL POINT
                 *
02A3 28 04 EC          PI    PRTLN          PRINT IT
                 *
                 * CHECK STOP
                 *
02A6 28 03 D6          PI    STOP
                 *
                 * PRINT RESET TOTAL MONEY
```

```
                        *
02A9 2A 20 07                 DCI   RMONTL
02AC 28 03 EE                 PI    LOAD3
02AF 28 04 10                 PI    NICKL
                        *
                        * LOAD PRINT BUFFER
                        *
02B2 20 11                    LI    BUF1
02B4 0B                       LR    IS,A
02B5 20 54                    LI    C'T'
02B7 5D                       LR    I,A
02B8 20 52                    LI    C'R'              TR $
02BA 5D                       LR    I,A
02BB 4D                       LR    A,I               SKIP SPACE
02BC 4D                       LR    A,I
02BD 4D                       LR    A,I
02BE 20 24                    LI    C'$'
02C0 5D                       LR    I,A
02C1 20 38                    LI    BUFAD
02C3 0B                       LR    IS,A
02C4 76                       LIS   6
02C5 50                       LR    CNT,A
02C6 28 03 E6                 PI    LDX2              SHIFT ASCII INTO PRINT BUFFER
02C9 28 03 DC                 PI    DP                ADD DEC. PT.
02CC 28 04 EC                 PI    PRTLN             PRINT THE LINE
                        *
                        * CHECK STOP
                        *
02CF 28 03 D6                 PI    STOP
                        *
02D2 28 04 EC                 PI    PRTLN
                        *
                        * PRINT POWER FAIL
                        *
02D5 2A 20 0A                 DCI   PFAIL
02D8 70                       CLR
02D9 50                       LR    HB,A
02DA 51                       LR    MB,A
02DB 16                       LM
02DC 52                       LR    LB,A
02DD 28 04 34                 PI    ASCII             CONVERT IT
                        *
                        * LOAD PRINT BUFFER
                        *
02E0 20 11                    LI    BUF1
02E2 0B                       LR    IS,A
02E3 20 50                    LI    C'P'
02E5 5D                       LR    I,A
02E6 20 49                    LI    C'I'
02E8 5D                       LR    I,A
02E9 20 3B                    LI    BUFAD+3
02EB 0B                       LR    IS,A
02EC 73                       LIS   3
02ED 50                       LR    CNT,A
02EE 28 03 E6                 PI    LDX2              MOVE CHARS.
02F1 28 04 EC                 PI    PRTLN             PRINT THE LINE
                        *
                        * CHECK STOP
                        *
02F4 28 03 D6                 PI    STOP
                        *
                        *
                        * PRINT HEADER
                        *
02F7 28 04 EC                 PI    PRTLN
                        *
02FA 28 03 D6                 PI    STOP
                        *
                        * PRINT HEADER
                        *
```

```
02FD 20 11              LI    BUF1
02FF 0B                 LR    IS,A
0300 20 53              LI    C'S'
0302 5D                 LR    I,A
0303 20 23              LI    C'#'
0305 5D                 LR    I,A
0306 4D                 LR    A,I
0307 20 49              LI    C'I'
0309 5D                 LR    I,A
030A 20 52              LI    C'R'
030C 5D                 LR    I,A
030D 20 18              LI    BUF3
030F 0B                 LR    IS,A
0310 20 49              LI    C'I'
0312 5D                 LR    I,A
0313 20 4E              LI    C'N'
0315 5D                 LR    I,A
0316 20 52              LI    C'R'
0318 5D                 LR    I,A
0319 20 1E              LI    BUF4
031B 0B                 LR    IS,A
031C 20 24              LI    C'$'
031E 5D                 LR    I,A
031F 20 4E              LI    C'N'
0321 5D                 LR    I,A
0322 64                 LISU  4
0323 20 52              LI    C'R'
0325 5D                 LR    I,A
0326 28 04 EC           PI    PRTLN
                 *
                 * CHECK STOP
                 *
0329 28 03 D6           PI    STOP
                 *
                 *
                 *
                 *  INIT SEL # PRINT LOOP
                 *
032C 20 26              LI    BUFP
032E 0B                 LR    IS,A
032F 2A 20 0B           DCI   MAXIT       GET MAX ITEMS
0332 16                 LM
0333 25 1E              CI    30
0335 82 03              BC    MX1
0337 20 1E              LI    30
0339 5D          MX1    LR    I,A
033A 70                 CLR
033B 5C                 LR    S,A         INDEX FOR SEL. DATA
                 *
                 * PRINT LOOP
033C 20 27       DLOOP  LI    BUFP+1
033E 0B                 LR    IS,A        GET INDEX
033F 4C                 LR    A,S
0340 1F                 INC               CONVERT INDEX
0341 52                 LR    LB,A
0342 70                 CLR
0343 51                 LR    MB,A
0344 50                 LR    HB,A
0345 28 04 34           PI    ASCII       CONVERT
0348 28 03 C9           PI    MOVA        MOVE TO DIRECT SCRATCHPAD
034B 20 11              LI    BUF1        FIRST BUFFER
034D 0B                 LR    IS,A
034E 44                 LR    A,4
034F 5D                 LR    I,A
0350 45                 LR    A,5
0351 5D                 LR    I,A
0352 20 27              LI    BUFP+1      GET INDEX
0354 0B                 LR    IS,A
0355 2A 20 0D           DCI   STORE       BASE RAM ADDRESS
0358 4C                 LR    A,S         GET INDEX
```

```
0359 13                SL    1
035A 13                SL    1          X4
035B 8E                ADC              ADD TO DC
035C 8E                ADC              ADD TO DC INDEX X8
035D 28 03 F5          PI    LOAD2      ITEMS RESET TO CONVERTER
0360 28 04 34          PI    ASCII
0363 28 03 C9          PI    MOVA
0366 20 14             LI    BUF2       STICK IT IN 2ND BUFFER
0368 0B                LR    IS,A
0369 43                LR    A,3
036A 5D                LR    I,A
036B 44                LR    A,4
036C 5D                LR    I,A
036D 45                LR    A,5
036E 5D                LR    I,A
               *
036F 28 03 EE          PI    LOAD3      ITEMS NON-RESET
0372 28 04 34          PI    ASCII
0375 28 03 C9          PI    MOVA
0378 20 18             LI    BUF3
037A 0B                LR    IS,A
037B 41                LR    A,1
037C 5D                LR    I,A
037D 42                LR    A,2
037E 5D                LR    I,A
037F 43                LR    A,3
0380 5D                LR    I,A
0381 44                LR    A,4
0382 5D                LR    I,A
0383 45                LR    A,5
0384 5D                LR    I,A
               *
0385 28 03 EE          PI    LOAD3      NICKELS NON-RESET
0388 28 04 10          PI    NICKL
038B 28 03 C9          PI    MOVA
038E 20 1E             LI    BUF4
0390 0B                LR    IS,A
0391 40                LR    A,0
0392 5D                LR    I,A
0393 41                LR    A,1
0394 5D                LR    I,A
0395 20 20             LI    BUF5
0397 0B                LR    IS,A
0398 42                LR    A,2
0399 5D                LR    I,A
039A 43                LR    A,3
039B 5D                LR    I,A
039C 20 2E             LI    C'.'
039E 5D                LR    I,A
039F 44                LR    A,4
03A0 5D                LR    I,A
03A1 45                LR    A,5
03A2 5D                LR    I,A
03A3 28 04 EC          PI    PRTLN      PRINT THE LINE
03A6 28 03 D6          PI    STOP
03A9 20 27             LI    BUFF+1
03AB 0B                LR    IS,A
03AC 4C                LR    A,S        INCREMENT INDEX
03AD 1F                INC
03AE 5E                LR    D,A
03AF 3C                DS    S          DECR MAXIT
03B0 94 8B             BNZ   DLOOP
               *
               *
               * SET PRTFL
               *
03B2 2A 20 0C          DCI   PRTFL
03B5 7F                LIS   15
03B6 17                ST
               *
```

```
                    * END OF PRINT LOOP
                    *
                    * PRINT 5 LINES
                    *
03B7 28 04 EC                PI     PRTLN
03BA 28 04 EC                PI     PRTLN
03BD 28 04 EC                PI     PRTLN
03C0 28 04 EC                PI     PRTLN
03C3 28 04 EC                PI     PRTLN
                    *
                    *
03C6 29 00 1E PREND          JMP    MODE            GO BACK; DONE
                    *
                    *
                    *
03C9 20 38          MOVA     LI     BUFAD
03CB 0B                      LR     IS,A
03CC 76                      LIS    6
03CD 57                      LR     7,A
03CE 67             MOVA1    LISU   7
03CF 4C                      LR     A,S
03D0 60                      LISU   0
03D1 5D                      LR     I,A
03D2 37                      DS     7
03D3 94 FA                   BNZ    MOVA1
03D5 1C                      POP
                    *
03D6 A4             STOP     INS    PSW
03D7 21 40                   NI     MSTOP
03D9 94 EC                   BNZ    PREND           STOP IF NECC.
03DB 1C                      POP
                    *
                    *
                    *
03DC 5E             DP       LR     D,A             DECIMAL POINT ADDER
03DD 4D                      LR     A,I
03DE 5E                      LR     D,A
03DF 4E                      LR     A,D
03E0 4D                      LR     A,I
03E1 5E                      LR     D,A
03E2 20 2E                   LI     C'.'
03E4 5C                      LR     S,A
03E5 1C                      POP
                    *
03E6 67             LDX2     LISU   7
03E7 4C                      LR     A,S
03E8 63                      LISU   3
03E9 5D                      LR     I,A
03EA 30                      DS     CNT
03EB 94 FA                   BNZ    LDX2
03ED 1C                      POP
03EE 16             LOAD3    LM
03EF 50                      LR     HB,A
03F0 16                      LM
03F1 51                      LR     MB,A
03F2 16                      LM
03F3 52                      LR     LB,A
03F4 1C                      POP
03F5 70             LOAD2    CLR
03F6 50                      LR     HB,A
03F7 16                      LM
03F8 51                      LR     MB,A
03F9 16                      LM
03FA 52                      LR     LB,A
03FB 1C                      POP
                    *
                             ORG    H'400'
                    *
                    * ASCII LOADER
                    *
```

```
0400 40       HD1     LR    A,CNT
0401 0B               LR    IS,A
0402 16               LM
0403 5C               LR    S,A
0404 40               LR    A,CNT
0405 1F               INC
0406 50               LR    CNT,A
0407 4C               LR    A,S
0408 25 0D            CI    H'0D'
040A 94 F5            BNZ   HD1
040C 20 20            LI    H'20'
040E 5C               LR    S,A
040F 1C               POP
                      *
                      *
                      *  NICKEL TO BINARY CONVERTER
                      *  (BASE 5 TO BASE 2 CONVERTER)
                      *
0410 40       NICKL   LR    A,HB            MASK FOR OVERFLOW
0411 21 03            NI    3
0413 50               LR    HB,A            SAVE
0414 13               SL    1               X4 HB
0415 13               SL    1
0416 53               LR    HB1,A
0417 41               LR    A,MB
0418 14               SR    4
0419 12               SR    1
041A 12               SR    1
041B C3               AS    HB1
041C 53               LR    HB1,A           SAVE HBX4
041D 41               LR    A,MB            X4 MB
041E 13               SL    1
041F 13               SL    1
0420 54               LR    MB1,A
0421 42               LR    A,LB
0422 14               SR    4
0423 12               SR    1
0424 12               SR    1
0425 C4               AS    MB1
0426 54               LR    MB1,A           SAVE MBX4
0427 42               LR    A,LB            X4LB
0428 13               SL    1
0429 13               SL    1
042A C2               AS    LB              ADD LB X1
042B 52               LR    LB,A            SAVE LB
042C 44               LR    A,MB1           X4MB+CARRY+MB
042D 19               LNK
042E C1               AS    MB
042F 51               LR    MB,A            SAVE MB
0430 43               LR    A,HB1           X4HB+CARRY+HB
0431 19               LNK
0432 C0               AS    HB
0433 50               LR    HB,A
                      *
                      * END CONVERSION
                      *
                      *
                      * 20 BIT BINARY TO 6 CHARACTER ASCII CONVERTER
                      *
                      *
0434 20 38    ASCII   LI    BUFAD
0436 0B               LR    IS,A
0437 20 30            LI    C'0'            ASCII 0
0439 5D       CLX     LR    I,A             CLEAR BUFFER
043A 8F FE            BR7   CLX
043C 20 38            LI    BUFAD
043E 0B               LR    IS,A            INIT ISAR
                      *
043F 40               LR    A,HB            MASK OVERFLOW
0440 21 0F            NI    H'0F'
```

```
0442 50                  LR    HB,A       PUT IT BACK
                *
0443 40         TOP      LR    A,HB       LOADHI BYTE
0444 25 01               CI    H'01'      COMPARE
0446 84 05               BZ    MED        IF EQUAL, CHECK MIDDLE BYTE
0448 92 11               BNC   INCR       IF LARGER, INCR. DIGIT
044A 82 22               BC    NEXT       IF SMALLER, DO NEXT DIGIT
044C 41         MED      LR    A,MB       LOAD MIDDLE BYTE
044D 25 86               CI    H'86'      COMPARE
044F 84 05               BZ    LOW        IF EQUAL, CHECK LO BYTE
0451 92 08               BNC   INCR       IF LARGER, INCREMENT DIGIT
0453 82 19               BC    NEXT       IF SMALLER, GO TO NEXT DIGIT
0455 42         LOW      LR    A,LB       LOAD LOW BYTE
0456 25 9F               CI    H'9F'      COMPARE
0458 82 14               BC    NEXT       IF SMALLER,GO TO NEXT DIGIT
                *
                *  INCREMENT DIGIT
                *
045A 4C         INCR     LR    A,S        LOAD DIGIT
045B 1F                  INC              INCREMENT
045C 5C                  LR    S,A        SAVE DIGIT
                *
                * TRIPLE BYTE SUBTRACT 100000
                *
045D 42                  LR    A,LB       LOW BYTE
045E 24 60               AI    H'60'      SUBTRACT
0460 52                  LR    LB,A       SAVE
0461 41                  LR    A,MB       MIDDLE BYTE
0462 19                  LNK              ADD CARRY
0463 24 79               AI    H'79'      SUBTRACT
0465 51                  LR    MB,A       SAVE
0466 40                  LR    A,HB       HI BYTE
0467 19                  LNK              ADD CARRY
0468 24 FE               AI    H'FE'      SUBTRACT
046A 50                  LR    HB,A       SAVE
046B 90 D7               BR    TOP        GO BACK FOR ANOTHER COMPARE
                *
                *
                *  DOUBLE BYTE COMPARE
                *
046D 4D         NEXT     LR    A,I        INCREMENT ISAR
046E 40         NXT1     LR    A,HB       CHECK HB
046F 25 01               CI    1
0471 84 0F               BZ    INC1       IF 1, INCREMENT DIGIT
0473 41                  LR    A,MB       LOAD HI BYTE
0474 25 27               CI    H'27'      COMPARE
0476 84 05               BZ    *+6        IF EQUAL, CHECK LOW BYTE
0478 92 08               BNC   *+9        IF LARGER, INCREMENT DIGIT
047A 82 1A               BC    NXT8       IF SMALLER, GO TO NEXT DIGIT
047C 42                  LR    A,LB       LOAD LOW BYTE
047D 25 0F               CI    H'0F'      COMPARE
047F 82 15               BC    NXT8       IF SMALLER, GO TO NEXT DIGIT
                *
                *  INCREMENT DIGIT
                *
0481 4C         INC1     LR    A,S        LOAD DIGIT
0482 24 01               AI    1          ADD 1
0484 5C                  LR    S,A        PUT IT BACK
                *
                *  DOUBLE BYTE SUBTRACT
                *
0485 42                  LR    A,LB       FETCH LOW BYTE
0486 24 F0               AI    H'F0'
0488 52                  LR    LB,A       PUT IT BACK
0489 41                  LR    A,MB       FETCH HI BYT~E
048A 19                  LNK              ADD CARRY
048B 24 D8               AI    H'D8'
048D 51                  LR    MB,A       PUT HI BYTE BACK
048E 40                  LR    A,HB       SUBTRACT FROM HB
048F 19                  LNK
```

```
0490 24 FF              AI     H'FF'
0492 50                 LR     HB,A          SAVE
0493 90 DA              BR     NXT1          GO BACK AND TEST
                  *
                  *
                  *  SECOND DIGIT CONVERSION
                  *
                  *  DOUBLE BYTE COMPARE
                  *
0495 4D           NXT8  LR     A,I           INCREMENT ISAR
0496 41                 LR     A,MB          LOAD HI BYTE
0497 25 03              CI     H'03'
0499 84 05              BZ     *+6           IF EQUAL, CHECK LOW BYTE
049B 92 08              BNC    *+9           IF LARGER, INCREMENT DIGIT
049D 82 15              BC     *+22
049F 42                 LR     A,LB          LOAD LOW BYTE
04A0 25 E7              CI     H'E7'
04A2 82 10              BC     *+17
                  *
                  *  INCREMENT DIGIT
                  *
04A4 4C                 LR     A,S
04A5 24 01              AI     1             ADD 1
04A7 5C                 LR     S,A
                  *
                  *  DOUBLE BYTE SUBTRACT
                  *
04A8 42                 LR     A,LB          FETCH LOW BYTE
04A9 24 18              AI     H'18'
04AB 52                 LR     LB,A          PUT IT BACK
04AC 41                 LR     A,MB          FETCH HI BYT~E
04AD 19                 LNK                  ADD CARRY
04AE 24 FC              AI     H'FC'
04B0 51                 LR     MB,A          PUT HI BYTE BACK
04B1 90 E4              BR     *-27          GO BACK AND TEST
                  *
                  *
                  *  THIRD DIGIT CONVERSION
                  *
                  *  DOUBLE BYTE COMPARE
                  *
04B3 4D                 LR     A,I           INCREMENT ISAR
04B4 41                 LR     A,MB          LOAD HI BYTE
04B5 25 00              CI     0
04B7 84 05              BZ     *+6           IF EQUAL, CHECK LOW BYTE
04B9 92 08              BNC    *+9
04BB 82 15              BC     *+22
04BD 42                 LR     A,LB          LOAD LOW BYTE
04BE 25 63              CI     H'63'
04C0 82 10              BC     *+17
                  *
                  *  INCREMENT DIGIT
                  *
04C2 4C                 LR     A,S
04C3 24 01              AI     1             ADD 1
04C5 5C                 LR     S,A
                  *
                  *  DOUBLE BYTE SUBTRACT
                  *
04C6 42                 LR     A,LB          FETCH LOW BYTE
04C7 24 9C              AI     H'9C'
04C9 52                 LR     LB,A          PUT IT BACK
04CA 41                 LR     A,MB          FETCH HI BYT~E
04CB 19                 LNK                  ADD CARRY
04CC 24 FF              AI     H'FF'
04CE 51                 LR     MB,A          PUT HI BYTE BACK
04CF 90 E4              BR     *-27          GO BACK AND TEST
                  *
                  *
                  *  FOURTH DIGIT CONVERSION
```

```
                     *
                     *  DOUBLE BYTE COMPARE
                     *
04D1 4D                      LR     A,I             INCREMENT ISAR
04D2 42                      LR     A,LB            LOAD LOW BYTE
04D3 25 09                   CI     H'09'
04D5 82 10                   BC     *+17
                     *
                     *  INCREMENT DIGIT
                     *
04D7 4C                      LR     A,S
04D8 24 01                   AI     1               ADD 1
04DA 5C                      LR     S,A
                     *
                     *  DOUBLE BYTE SUBTRACT
                     *
04DB 42                      LR     A,LB            FETCH LOW BYTE
04DC 24 F6                   AI     H'F6'
04DE 52                      LR     LB,A            PUT IT BACK
04DF 41                      LR     A,MB            FETCH HI BYT~E
04E0 19                      LNK                    ADD CARRY
04E1 24 FF                   AI     H'FF'
04E3 51                      LR     MB,A            PUT HI BYTE BACK
04E4 90 ED                   BR     *-18            GO BACK TO TEST
                     *
                     *
                     *  FINAL DIGIT CONVERSION
                     *
                     *
04E6 4D                      LR     A,I             INCREMENT ISAR
04E7 42                      LR     A,LB            FETCH REMAINDER
04E8 22 30                   OI     H'30'           MAKE IT AN ASCII CHAR.
04EA 5C                      LR     S,A            STORE IN LSD
04EB 1C                      POP                    END SUBROUTINE
                     *
                     *
04EC 20 11           PRTLN   LI     H'11'           DIR = TRUE (LEFT) CHRP=1
04EE 50                      LR     DIR,A
04EF 71                      LIS    1
04F0 51                      LR     LINE,A          LINE = 1
04F1 70                      CLR
04F2 52                      LR     DOT,A           DOT = 0
04F3 56                      LR     PRFLG,A         PRFLG = FALSE
04F4 74                      LIS    4               ROW = 4
04F5 53                      LR     ROW,A
04F6 71                      LIS    1               CHR=1
04F7 57                      LR     CHR,A
                     *
                     * SELECT P1 DOTS
                     *
04F8 70              SEL1    CLR
04F9 54                      LR     STOR1,A         CLEAR DOT STORAGE
04FA 55                      LR     STOR2,A
04FB 45              LOOP    LR     A,STOR2         SHIFT DOTS
04FC 13                      SL     1
04FD 55                      LR     STOR2,A
04FE 44                      LR     A,STOR1         CHECK FOR DOT CARRY
04FF 21 80                   NI     H'80'
0501 84 05                   BZ     SKIP
0503 45                      LR     A,STOR2         ADD 1
0504 22 01                   OI     1
0506 55                      LR     STOR2,A         SAVE
0507 44              SKIP    LR     A,STOR1         SHIFT
0508 13                      SL     1
0509 54                      LR     STOR1,A
                     *
                     *  GET A DOT
                     *
050A 2A 06 19                DCI    BASE            POINT TO DOT TABLE
050D 43                      LR     A,ROW           GET ROW
```

```
050E 15                 SL     4          X16
050F 8E                 ADC               ADD X64
0510 8E                 ADC
0511 8E                 ADC
0512 8E                 ADC               ADD
0513 47                 LR     A,CHR      ADDRESS BUFFER
0514 18                 COM               2'S COMPLEMENT
0515 24 01              AI     1
0517 24 15              AI     21         SUBTRACT FROM 21
0519 24 10              AI     ADDR
051B 0B                 LR     IS,A       TRANSFER TO ISAR
051C 4C                 LR     A,S        GET CHARACTER
051D 21 3F              NI     H'3F'      MASK TO MAKE CHAR. INDEX
051F 8E                 ADC               DC = BASE+ROW+CHAR. INDEX
0520 16                 LM                GET DOTS
0521 F1                 NS     LINE       MASK FOR DOT
0522 84 05              BZ     SKP        IF OFF, SKIP
0524 44                 LR     A,STOR1    LSB = 1 OF DOTS
0525 22 01              OI     1
0527 54                 LR     STOR1,A    SAVE
0528 47         SKP     LR     A,CHR      INCR CHR
0529 24 02              AI     2
052B 57                 LR     CHR,A
052C 25 14              CI     20
052E 82 CC              BC     LOOP       NO; LOOP
                *
                * TURN DOTS OFF
                *
0530 20 FF      SKP1    LI     H'FF'
0532 B0                 OUTS   PDOTL
0533 B1                 OUTS   PDOTH
                *
                *  CHECK PRINT FLAG
                *
0534 46                 LR     A,PRFLG
0535 21 FF              NI     H'FF'
0537 94 0B              BNZ    ST2        SKIP IF ON
                *
                * TURN MOTOR ON
                *
0539 20 C0              LI     MOTON
053B B5                 OUTS   PMOT
053C A4         ST1     INS    PORT       CHECK FOR PRINT START
053D 21 01              NI     MPSTRT
053F 84 FC              BZ     ST1        WAIT
0541 7F                 LIS    15         PRINT FLAG = TRUE
0542 56                 LR     PRFLG,A
                *
0543 A4         ST2     INS    PORT       WAIT FOR STROBE P1
0544 21 02              NI     MSTP1
0546 84 FC              BZ     ST2
                *
0548 42                 LR     A,DOT      INCREMENT DOT COUNTER
0549 1F                 INC
054A 52                 LR     DOT,A
                *
054B 44                 LR     A,STOR1    ENERGISE DOTS
054C 18                 COM
054D B0                 OUTS   PDOTL
054E 45                 LR     A,STOR2
054F 18                 COM
0550 B1                 OUTS   PDOTH
                *
0551 40                 LR     A,DIR      CHECK DIR
0552 21 01              NI     1
0554 84 0E              BZ     RIG
0556 33                 DS     ROW        DECREMENT ROW
0557 82 1A              BC     RIGX       RESET CHR
0559 74                 LIS    4          RESET ROW
055A 53                 LR     ROW,A
```

```
0558 40                  LR    A,DIR         CHRP=2
055C 21 0F               NI    H'0F'
055E 22 20               OI    H'20'
0560 50                  LR    DIR,A
0561 90 10               BR    RIGX
0563 43         RIG      LR    A,ROW         INCR ROW
0564 1F                  INC
0565 53                  LR    ROW,A
0566 25 04               CI    4
0568 82 09               BC    RIGX          IF NOT TOO BIG, SKIP
056A 70                  CLR                 ROW = 0
056B 53                  LR    ROW,A
056C 40                  LR    A,DIR         CHRP=1
056D 21 0F               NI    H'0F'
056F 22 10               OI    H'10'
0571 50                  LR    DIR,A
0572 40         RIGX     LR    A,DIR
0573 14                  SR    4             RESET CHR
0574 57                  LR    CHR,A
                *
                *
                *  SELECT P2 DOTS
                *
0575 70                  CLR
0576 54                  LR    STOR1,A       CLEAR DOT STORAGE
0577 55                  LR    STOR2,A
0578 45         LOP1     LR    A,STOR2       SHIFT DOTS
0579 13                  SL    1
057A 55                  LR    STOR2,A
057B 44                  LR    A,STOR1       CHECK FOR DOT CARRY
057C 21 80               NI    H'80'
057E 84 05               BZ    SKPP
0580 45                  LR    A,STOR2       ADD 1
0581 22 01               OI    1
0583 55                  LR    STOR2,A       SAVE
0584 44         SKPP     LR    A,STOR1       SHIFT
0585 13                  SL    1
0586 54                  LR    STOR1,A
                *
                *  GET A DOT
                *
0587 2A 06 19            DCI   BASE          POINT TO DOT TABLE
058A 43                  LR    A,ROW         GET ROW
058B 15                  SL    4             X16
058C 8E                  ADC                 ADD X64
058D 8E                  ADC
058E 8E                  ADC
058F 8E                  ADC                 ADD
0590 47                  LR    A,CHR         ADDRESS BUFFER
0591 18                  COM
0592 24 01               AI    1
0594 24 15               AI    21
0596 24 10               AI    ADDR
0598 0B                  LR    IS,A          TRANSFER TO ISAR
0599 4C                  LR    A,S           GET CHARACTER
059A 21 3F               NI    H'3F'         MASK TO MAKE CHAR. INDEX
059C 8E                  ADC                 DC = BASE+ROW+CHAR. INDEX
059D 16                  LM                  GET DOTS
059E F1                  NS    LINE          MASK FOR DOT
059F 84 05               BZ    SKX           IF OFF, SKIP
05A1 44                  LR    A,STOR1       LSB = 1 OF DOTS
05A2 22 01               OI    1
05A4 54                  LR    STOR1,A       SAVE
05A5 47         SKX      LR    A,CHR         INDR BY 2
05A6 24 02               AI    2
05A8 57                  LR    CHR,A
05A9 25 14               CI    20
05AB 82 CC               BC    LOP1          NO; LOP1
                *
                * CLEAR DOTS
```

```
                    *
05AD 20 FF   SKX1   LI    H'FF'
05AF B0             OUTS  PDOTL
05B0 B1             OUTS  PDOTH
                    *
05B1 A4      ST3    INS   PORT        CHECK STROBE P2
05B2 21 04          NI    MSTP2
05B4 84 FC          BZ    ST3
                    *
05B6 42             LR    A,DOT       INCREMENT DOT COUNTER
05B7 1F             INC
05B8 52             LR    DOT,A
                    *
05B9 44             LR    A,STOR1     ENERGIZE DOTS
05BA 18             COM
05BB B0             OUTS  PDOTL
05BC 45             LR    A,STOR2
05BD 18             COM
05BE B1             OUTS  PDOTH
                    *
                    *
                    * CHECK DIRECTION
                    *
05BF 40             LR    A,DIR
05C0 21 01          NI    1
05C2 94 0F          BNZ   LEFT
05C4 43             LR    A,ROW       INCREMENT ROW
05C5 1F             INC
05C6 53             LR    ROW,A
05C7 25 04          CI    4           ROW > 4?
05C9 82 13          BC    REPL        NO,GO BACK
05CB 74             LIS   4
05CC 53             LR    ROW,A       ROW = 5
05CD 20 11          LI    H'11'       CHRP = 1, DIR = 1 LEFT
05CF 50             LR    DIR,A       DIR = 1 (LEFT)
05D0 90 09          BR    SHIFT       DO LINE SHIFT
                    *
05D2 33      LEFT   DS    ROW         DECREMENT ROW COUNTER
05D3 82 09          BC    REPL        GO BACK IF NOT 0
05D5 70             CLR               ROW = 0
05D6 53             LR    ROW,A
05D7 20 20          LI    H'20'       DIR = RIGHT, CHRP=2
05D9 50             LR    DIR,A
05DA 41      SHIFT  LR    A,LINE      SHIFT LINE MASK
05DB 13             SL    1
05DC 51             LR    LINE,A
05DD 40      REPL   LR    A,DIR       SET CHR
05DE 14             SR    4
05DF 57             LR    CHR,A       CHR = CHRP
                    *
                    * CHECK FOR END OF LINE
                    *
05E0 42      SEL3   LR    A,DOT
05E1 25 46          CI    70          DOT = 70?
05E3 84 04          BZ    SPACE       DO SPACES
                    *
05E5 29 04 F8       JMP   SEL1        RETURN TO TOP
                    *
                    * DO SPACING BETWEEN LINES
                    *
05E8 20 87   SPACE  LI    135         WAIT 2.4 MS. FOR THERMAL
05EA 2B      SPI    NOP               ELEMENTS
05EB 2B             NOP
05EC 2B             NOP
05ED 1F             INC
05EE 94 FB          BNZ   SPI
                    *
05F0 20 FF          LI    H'FF'       TURN DOTS OFF
05F2 B0             OUTS  PDOTL
05F3 B1             OUTS  PDOTH
```

```
                    *
05F4 A4             SPACE1   INS    PORT          WAIT FOR STROBE P1
05F5 21 02                   NI     MSTP1
05F7 84 F0                   BZ     SPACE
                    *
                    * INCREMENT DOT COUNTER
                    *
05F9 42                      LR     A,DOT
05FA 1F                      INC
05FB 52                      LR     DOT,A
                    *
                    * WAIT FOR STROBE P2
                    *
05FC A4             ST5      INS    PORT
05FD 21 04                   NI     MSTP2
05FF 84 FC                   BZ     ST5
                    *
                    * INCREMENT DOT COUNTER
                    *
0601 42                      LR     A,DOT
0602 1F                      INC
0603 52                      LR     DOT,A
                    *
0604 25 5A                   CI     90            DOTS = 90?
0606 94 ED                   BNZ    SPACE1        NO; DO MORE SPACE
                    *
                    * TURN OFF MOTOR
                    *
0608 20 40                   LI     MOTOF
060A B5                      OUTS   PMOT
                    *
                    *  CLEAR BUFFER
                    *
060B 20 14          CLEAR    LI     20            20 CHAR. IN BUFFER
060D 50                      LR     CNT,A
060E 40             CL1      LR     A,CNT         GET CHAR. NO.
060F 24 10                   AI     ADDR          BUFFER OFFSET
0611 0B                      LR     IS,A
0612 20 20                   LI     H'20'         SPACE
0614 5C                      LR     S,A           SAVE IN BUFFER
0615 30                      DS     CNT           DECREMENT CHAR. COUNTER
0616 94 F7                   BNZ    CL1
0618 1C                      POP                  RETURN
                    *
                    *
                    *  DOT PATTERNS
                    *
                    * COLUMN 1
                    *
                    * @-G
0619 3E 7E          BASE     DC     H'3E7E'
061B 7F 3E                   DC     H'7F3E'
061D 7F 7F                   DC     H'7F7F'
061F 7F 3E                   DC     H'7F3E'
                    * H-O
0621 7F 00                   DC     H'7F00'
0623 20 7F                   DC     H'207F'
0625 7F 7F                   DC     H'7F7F'
0627 7F 3E                   DC     H'7F3E'
                    * P-W
0629 7F 3E                   DC     H'7F3E'
062B 7F 46                   DC     H'7F46'
062D 01 3F                   DC     H'013F'
062F 07 7F                   DC     H'077F'
                    * X-[
0631 63 07                   DC     H'6307'
0633 61 7F                   DC     H'617F'
0635 03 00                   DC     H'0300'
0637 02 40                   DC     H'0240'
                    *   -'
```

```
14700 0639 00                DC      H'0000'
14710 063A 00                DC      0
14720 063B 00                DC      0
14730 063C 14                DC      H'0014'
14740 063D 24 63             DC      H'2463'
14750 063F 60 00             DC      H'6000'
14760                  * (-/
14770 0641 00                DC      H'0000'
14780 0642 00                DC      0
14790 0643 14 08             DC      H'1408'
14800 0645 40 08             DC      H'4008'
14810 0647 40 60             DC      H'4060'
14820                  * 0-7
14830 0649 3E 44             DC      H'3E44'
14840 064B 62 41             DC      H'6241'
14850 064D 18 27             DC      H'1827'
14860 064F 3C 01             DC      H'3C01'
14870                  * 8-?
14880 0651 36 46             DC      H'3646'
14890 0653 00                DC      0
14900 0654 40                DC      H'0040'
14910 0655 08 14             DC      H'0814'
14920 0657 41 02             DC      H'4102'
14930                  *
14940                  * COLUMN 1 DOT PATTERNS
14950                  *
14960                  * @-G
14970 0659 41 09             DC      H'4109'
14980 065B 49 41             DC      H'4941'
14990 065D 41 49             DC      H'4149'
15000 065F 09 41             DC      H'0941'
15010                  * H-O
15020 0661 08 41             DC      H'0841'
15030 0663 40 08             DC      H'4008'
15040 0665 40 02             DC      H'4002'
15050 0667 06 41             DC      H'0641'
15060                  * P-W
15070 0669 09 41             DC      H'0941'
15080 066B 09 49             DC      H'0949'
15090 066D 01 40             DC      H'0140'
15100 066F 18 20             DC      H'1820'
15110                  * X-[
15120 0671 14 08             DC      H'1408'
15130 0673 51 41             DC      H'5141'
15140 0675 04 00             DC      H'0400'
15150 0677 01 40             DC      H'0140'
15160                  *  -'
15170 0679 00                DC      H'0000'
15180 067A 00                DC      0
15190 067B 07 7F             DC      H'077F'
15200 067D 2A 13             DC      H'2A13'
15210 067F 4E 04             DC      H'4E04'
15220                  * (-/
15230 0681 1C 41             DC      H'1C41'
15240 0683 08 08             DC      H'0808'
15250 0685 30 08             DC      H'3008'
15260 0687 00                DC      0
15270 0688 10                DC      H'0010'
15280                  * 0-7
15290 0689 51 42             DC      H'5142'
15300 068B 51 41             DC      H'5141'
15310 068D 14 45             DC      H'1445'
15320 068F 4A 71             DC      H'4A71'
15330                  * 8-?
15340 0691 49 49             DC      H'4949'
15350 0693 00                DC      0
15360 0694 34                DC      H'0034'
15370 0695 14 14             DC      H'1414'
15380 0697 41 01             DC      H'4101'
15390                  *
```

```
                * DOT PATTERNS FOR COLUMN 2
                *
                * @-G
0699 5D 09              DC    H'5D09'
069B 49 41              DC    H'4941'
069D 41 49              DC    H'4149'
069F 09 41              DC    H'0941'
                * H-O
06A1 08 7F              DC    H'087F'
06A3 41 14              DC    H'4114'
06A5 40 0C              DC    H'400C'
06A7 08 41              DC    H'0841'
                * P-W
06A9 09 51              DC    H'0951'
06AB 19 49              DC    H'1949'
06AD 7F 40              DC    H'7F40'
06AF 60 18              DC    H'6018'
                * X-[
06B1 08 78              DC    H'0878'
06B3 49 41              DC    H'4941'
06B5 08 41              DC    H'0841'
06B7 01 40              DC    H'0140'
                *  -'
06B9 00                 DC    0
06BA 4F                 DC    H'004F'
06BB 00                 DC    0
06BC 14                 DC    H'0014'
06BD 7F 08              DC    H'7F08'
06BF 59 02              DC    H'5902'
                * (-/
06C1 22 22              DC    H'2222'
06C3 3E 3E              DC    H'3E3E'
06C5 00                 DC    0
06C6 08                 DC    H'0008'
06C7 00                 DC    0
06C8 08                 DC    H'0008'
                * 0-7
06C9 49 7F              DC    H'497F'
06CB 51 49              DC    H'5149'
06CD 12 45              DC    H'1245'
06CF 49 09              DC    H'4909'
                * 8-?
06D1 49 49              DC    H'4949'
06D3 44 00              DC    H'4400'
06D5 22 14              DC    H'2214'
06D7 22 51              DC    H'2251'
                *
                * DOT PATTERNS COLUMN 3
                *
                * @-G
06D9 55 09              DC    H'5509'
06DB 49 41              DC    H'4941'
06DD 22 49              DC    H'2249'
06DF 09 49              DC    H'0949'
                * H-O
06E1 08 41              DC    H'0841'
06E3 3F 22              DC    H'3F22'
06E5 40 02              DC    H'4002'
06E7 30 41              DC    H'3041'
                * P-W.
06E9 09 21              DC    H'0921'
06EB 29 49              DC    H'2949'
06ED 01 40              DC    H'0140'
06EF 18 20              DC    H'1820'
                * X-[
06F1 14 08              DC    H'1408'
06F3 45 00              DC    H'4500'
06F5 10 41              DC    H'1041'
06F7 01 40              DC    H'0140'
                *  -'
```

```
06F9 00                DC    H'0000'
06FA 00                DC    0
06FB 07 7F             DC    H'077F'
06FD 2A 64             DC    H'2A64'
06FF 26 01             DC    H'2601'
              * (-/
0701 41 1C             DC    H'411C'
0703 08 08             DC    H'0808'
0705 00                DC    0
0706 08                DC    H'0008'
0707 00                DC    0
0708 04                DC    H'0004'
              * 0-7
0709 45 40             DC    H'4540'
070B 49 55             DC    H'4955'
070D 7F 45             DC    H'7F45'
070F 49 05             DC    H'4905'
              * 8-?
0711 49 29             DC    H'4929'
0713 00                DC    0
0714 00                DC    H'0000'
0715 41 14             DC    H'4114'
0717 14 09             DC    H'1409'
              *
              * DOT PATTERNS COLUMN 4
              *
              * @-G
0719 1E 7E             DC    H'1E7E'
071B 36 22             DC    H'3622'
071D 1C 41             DC    H'1C41'
071F 01 7A             DC    H'017A'
              * H-O
0721 7F 00             DC    H'7F00'
0723 01 41             DC    H'0141'
0725 40 7F             DC    H'407F'
0727 7F 3E             DC    H'7F3E'
              * P-W
0729 06 5E             DC    H'065E'
072B 46 31             DC    H'4631'
072D 01 3F             DC    H'013F'
072F 07 7F             DC    H'077F'
              * X-[
0731 63 07             DC    H'6307'
0733 43 00             DC    H'4300'
0735 60 7F             DC    H'607F'
0737 02 40             DC    H'0240'
              *   -'
0739 00                DC    H'0000'
073A 00                DC    0
073B 00                DC    0
073C 14                DC    H'0014'
073D 12 63             DC    H'1263'
073F 50 00             DC    H'5000'
              * (-/
0741 00                DC    H'0000'
0742 00                DC    0
0743 14 08             DC    H'1408'
0745 00                DC    0
0746 08                DC    H'0008'
0747 00                DC    0
0748 03                DC    H'0003'
              * 0-7
0749 3E 40             DC    H'3E40'
074B 46 22             DC    H'4622'
074D 10 39             DC    H'1039'
074F 31 03             DC    H'3103'
              * 8-?
0751 36 1E             DC    H'361E'
0753 00                DC    0
0754 00                DC    H'0000'
```

```
0755 41 14          DC    H'4114'
0757 08 06          DC    H'0806'
               *
0759 4E      HBUF1  DC    C'N'
075A 41             DC    C'A'
075B 54             DC    C'T'
075C 49             DC    C'I'
075D 4F             DC    C'O'
075E 4E             DC    C'N'
075F 41             DC    C'A'
0760 4C             DC    C'L'
0761 20             DC    C' '
0762 52             DC    C'R'
0763 45             DC    C'E'
0764 4A             DC    C'J'
0765 45             DC    C'E'
0766 43             DC    C'C'
0767 54             DC    C'T'
0768 4F             DC    C'O'
0769 52             DC    C'R'
076A 53             DC    C'S'
076B 0D             DC    H'0D'
076C 44      HBUF2  DC    C'D'
076D 41             DC    C'A'
076E 54             DC    C'T'
076F 41             DC    C'A'
0770 20             DC    C' '
0771 41             DC    C'A'
0772 43             DC    C'C'
0773 51             DC    C'Q'
0774 55             DC    C'U'
0775 49             DC    C'I'
0776 53             DC    C'S'
0777 49             DC    C'I'
0778 54             DC    C'T'
0779 49             DC    C'I'
077A 4F             DC    C'O'
077B 4E             DC    C'N'
077C 0D             DC    H'0D'
077D 53      HBUF3  DC    C'S'
077E 59             DC    C'Y'
077F 53             DC    C'S'
0780 54             DC    C'T'
0781 45             DC    C'E'
0782 4D             DC    C'M'
0783 0D             DC    H'0D'
               *
        END
NUMBER OF ERRORS=  0

      01B9 ADD     0170 ADDR   =0010 ASCII  0434 A1     0036 A2     005A
BASE   0619 BUFAD =0038 BUFF   =0026 BUF1   =0011 BUF2  =0014 BUF3  =0018
BUF4  =001E BUF5  =0020 CHR    =0007 CK3     0186 CK4    018F CLBUF  00FE
CLEAR  060B CLX    0439 CL1     060E CNT    =0000 CNT1  =0003 CNT2  =0004
CNT3  =0005 DIR   =0000 DLOOP   033C DOT    =0002 DP     03DC DUMP   01C7
ERASE  01AC ER1    01AE ER2     01B6 ER3     01BD HB    =0000 HBUF1  0759
HBUF2  076C HBUF3  077D HB1    =0003 HD1     0400 H1     01D3 IDST  =2000
INCR   045A INC1   0481 LB     =0002 LB1    =0005 LDX2   03E6 LEFT   05D2
LINE  =0001 LOAD2  03F5 LOAD3   03EE LOOP    04FB LOP1   0578 LOW    0455
MAXIT =200B MB    =0001 MB1    =0004 MED     044C MMODE =0020 MODE   001E
MODE1  002B MONTL =2004 MOTOF  =0040 MOTON  =00C0 MOVA   03C9 MOVA1  03CE
MPSTRT=0001 MSEL  =0010 MSTOP  =0040 MSTP1  =0002 MSTP2 =0004 MTOT  =0008
MX1    0339 NEXT   046D NICKL   0410 NXT1    046E NXTS   0495 OVER   0196
PDOTH =0001 PDOTL =0000 PFAIL  =200A PMODE  =0004 PMOT  =0005 PORT  =0004
PREND  03C6 PRFLG =0006 PRTFL  =200C PRTLN   04EC PSEL  =0004 PSW   =0004
PTOT  =0004 READ   0212 REPL    05DD REPX    0163 RIG    0563 RIGX   0572
RMONTL=2007 ROW   =0003 RPL1    01A4 SEL1    04F8 SEL3   05E0 SHIFT  05DA
SKIP   0507 SKP    0528 SKPP    0584 SKP1    0530 SKX    05A5 SKX1   05AD
SPACE  05E8 SPACE1 05F4 SPI     05EA STOP    03D6 STORE =200D STOR1 =0004
STOR2 =0005 ST1    053C ST2     0543 ST3     05B1 ST5    05FC TEMP  =0008
```

```
TIMST =2002 TOP   0443 XA   0226 XB   022F XC   023A XXXX  00A0
X0     021A X1    0062 X10  00AC X11  00B6 X12  00C0 X13   00C2
X131   00C7 X14   00D3 X15  00DA X151 00E5 X16  010B X161  0127
X17    012A X2    006E X3   0078 X4   007A X5   0088 X6    008F
X7     0094 X8    00A3 X9   00A7
```

What we claim is:

1. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises a memory having locations in which resettable data can be stored, a connection between said vending machine and said data acquisition unit which enables said vending machine to transmit data to said data acquisition unit, a switch, a data processing means, and a data-receiving device which is connectable to said data acquisition unit to receive data from said acquisition unit, said data processing means normally responding to data transmitted by said vending machine to store said data in said locations in said memory, said data processing means responding to actuation of said switch to place said data acquisition unit in a data-yielding mode wherein said data processing means transfers said data from said data acquisition unit to said data-receiving device, said data processing means acting while said data acquisition unit is in said data-yielding mode to yield said resettable data to said data-receiving device while also retaining said resettable data in said locations in said memory, said data processing means subsequently responding to restoration of said switch to its normal condition and to the transmission of further data from said vending machine to be enabled to clear said resettable data from said locations in said memory.

2. A data acquisition unit as claimed in claim 1 wherein said data processing means is unable, prior to the restoration of said switch to its normal condition, to clear said resettable data from said locations in said memory.

3. A data acquisition unit as claimed in claim 1 wherein said data processing means is unable, prior to the transmission of said further data from said vending machine, to clear said resettable data from said locations in said memory.

4. A data acquisition unit as claimed in claim 1 wherein said data processing means is unable, prior to the restoration of said switch to its normal condition to clear said resettable data from said locations in said memory, and wherein said data processing means is unable, prior to the transmission of said further data from said vending machine to clear said resettable data from said locations in said memory.

5. A data acquisition unit as claimed in claim 1 wherein said memory has further locations therein in which non-resettable data can be stored, and wherein said data processing means retains said non-resettable data in said further memory locations as said data processing means transfers said resettable and said non-resettable data from said data acquisition unit to said data-receiving device.

6. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises a memory having locations in which non-resettable running counts corresponding to the numbers of vending operations initiated by the closings of predetermined ones of said selection switches can be stored, said memory having further locations in which resettable running counts corresonding to the number of vending operations initiated by the closings of said predetermined ones of said selection switches can be stored, said memory having still further locations in which non-resettable running counts of the sums of the prices of each of said products which are vended during said vending operations and which correspond to said predetermined ones of said selection switches can be stored, said memory having still further locations in which non-resettable running counts of sums of the prices of each of said products which are vended during said vending operations and which correspond to said predetermined ones of said selection switches can be stored, a data-receiving device to which data that is read from all of said memory locations can be applied, and data processing means that reads data from all of said memory locations and applies said data to said data-receiving device while retaining said non-resettable running counts within said locations of said memory.

7. A data acquisition unit as claimed in claim 6 wherein said data acquisition unit is in a data-yielding mode whenever said data-receiving device is attached to said data acquisition unit, and a switch that initiates said data-yielding mode, wherein said data acquisition unit continues to remain in said data-yielding mode after said data-receiving device has been separated from said data acquisition unit and said switch has been restored to its normal condition, and wherein a subsequent vending operation by said vending machine will take said data acquisition unit out of said data-yielding mode and place it in a data-storing mode.

8. A data acquisition unit as claimed in claim 6 wherein data is transferred from said vending machine to said data acquisition unit each time a vending operation is performed by said vending machine, and wherein said data which said vending machine transfers to said data acquisition unit directly and precisely reflects the selection number of the selection switch used to initiate the vending operation and also directly and precisely identifies the price of the vended product.

9. A data acquisition unit as claimed in claim 6 wherein data is transferred from said vending machine to said data acquisition unit each time a vending operation is performed by said vending machine, wherein the prices at which said vending machine can vend products can be changed from time to time by a route man, and wherein said data which said vending machine transfers to said data acquisition unit directly and precisely reflects the selection number of the selection switch used to initiate the vending operation and also directly and precisely identifies the currently-set price for the vended product.

10. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises

conductors extending from said data acquisition unit to said vending machine to receive serial bit streams containing digital logic data representing the vending of predetermined products during vending operations initiated by the closing of predetermined ones of said selection switches and also containing further digital logic data representing the prices of said predetermined products vended during said vending operations, a memory having locations in which running counts of the numbers of said predetermined products which are vended during said vending operations initiated by the closings of said predetermined ones of said selection switches can be stored, said memory having further locations in which running counts of the sums of the prices of said predetermined products which are vended during said vending operations can be stored, data processing means responsive to said serial bit streams to sense said digital logic data therein and to identify the selection switches that initiated said vending operations and to address the corresponding memory locations and to increment said running counts of the numbers of said predetermined products which are vended during said vending operations which are initiated by said predetermined ones of said selection switches, said data processing means also addressing the memory locations wherein said running counts of said sums of the prices of said predetermined products which are vended during said vending operations are stored to update said running counts, and a data accepting unit which can accept data from said data acquisition unit.

11. A data acquisition unit as claimed in claim **10** wherein one group of running counts of the number of said predetermined products which are vended during said vending operations initiated by the closings of said predetermined ones of said selection switches is non-resettable, and wherein a further group of running counts of the number of said predetermined products which are vended during said vending operations initiated by the closings of said predetermined ones of said selection switches is resettable.

12. A data acquisition unit as claimed in claim **10** wherein said running counts of said sums of the prices of said predetermined products which are vended during said vending operations are non-resettable.

13. A data acquisition unit as claimed in claim **10** wherein said running counts of said sums of the prices of said predetermined products which are vended during said vending operations are non-resettable, and wherein said memory has a still further location in which a non-resettable running count of the total of the prices of all of the products vended during said vending operations can be stored.

14. A data acquisition unit as claimed in claim **10** wherein said running counts of said sums of the prices of said predetermined products which are vended during said vending operations are non-resettable, wherein said memory has a still further location in which a non-resettable running count of the total of the prices of all of the products vended during said vending operations can be stored, wherein one group of running counts of the number of said predetermined products which are vended during said vending operations initiated by the closings of said predetermined ones of said selection switches is non-resettable, and wherein a further group of running counts of the number of said predetermined products which are vended during said vending operations initiated by the closings of said predetermined ones of said selection switches is resettable.

15. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises a memory having locations therein in which digital data can be stored, a connection between said data acquisition unit and said vending machine which causes digital data from said vending machine to be supplied to said data acquisition unit, data processing means that automatically responds to said digital data from said vending machine to store said digital data in locations in said memory, a connector to which a data-accepting unit can be connected to enable data from said locations in said memory to be transferred to said data-accepting unit whenever said data acquisition unit is in a data-transferring mode, a switch that is selectively actuable to place said data acquisition unit in said data-transferring mode, and said data processing means responding to the return of said switch to its normal condition and to the receipt of further digital data from said vending machine to automatically take said data acquisition unit out of said data-transferring mode and to place said data-accepting unit in said data-accepting mode.

16. A data acquisition unit as claimed in claim **15** wherein said data-accepting unit includes a printer, and wherein the actuation of said switch starts a cycle of operation of said printer.

17. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises a memory having locations therein in which digital data can be stored, a connection between said data acquisition unit and said vending machine which causes digital data from said vending machine to be supplied to said data acquisition unit, data processing means that automatically responds to said digital data from said vending machine to store said digital data in locations in said memory, a connection between a data-accepting unit and said data acquisition unit which enables data from said locations in said memory to be transferred to said data-accepting unit to provide a printout bearing running counts based on said digital data while said data acquisition unit is in a data-transferring mode, and a switch that is selectively actuatable to place said data acquisition unit in said data-transferring mode, said data-accepting unit being adapted to provide said printout bearing said running counts based on said digital data while said data acquisition unit is in said data-transferring mode, said data acquisition unit retaining all of said digital data in said locations while said printout is being printed, whereby said data acquisition unit can again supply said digital data to said data-accepting unit while said data acquisition unit is in said data-transferring mode so said data-accepting unit can provide further and identical printouts bearing said running counts based on said digital data while said data acquisition unit is in said data-transferring mode.

18. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises conductors extending from said data acquisition unit to said vending machine to receive serial bit streams containing digital logic data representing the vending of predetermined products during vending operations initiated by the closing of predetermined ones of said selection switches and also containing further digital logic data representing the prices of said predetermined products vended during said vending operations, a memory having locations in which non-resettable running counts of the numbers of said predetermined products which are vended during said vending operations initiated by the closing of said predetermined ones of said selection switches can be stored, said memory having another location in which a non-resettable running count of the total of the prices of all of the products vended during said vending operations can be stored, said memory having yet another location in which a resettable running count of the total of the prices of all of the products vended during said vending operations can be stored, data processing means responsive to said serial bit streams to sense said digital logic data therein and to identify the selection switches that initiated said vending operations and to address the corresponding memory locations and to increment said running counts of the numbers of said predetermined products which are vended during said vending operations initiated by said predetermined ones of said selection switches, said data processing means also addressing the memory locations wherein said running counts of the total of the prices of all of the products vended during said vending operations are stored to update said running counts, and a data accepting unit which can accept data from said data acquisition unit.

19. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises a memory having locations in which digital logic data can be stored whenever said data acquisition unit is in a data-accepting mode, a connector that can connect said data acquisition unit to a data-receiving unit whenever said data acquisition unit is in a data-yielding mode, a selectively-actuable switch that can be actuated to place said data acquisition unit in said data-yielding mode, said data acquisition unit responding to the termination of said actuation of said switch and to the receipt of data from said vending machine to automatically shift out of said data-yielding mode and into said data-receiving mode.

20. A data acquisition unit, which is connectable to a money-operated, multi-selection vending machine that responds to the insertion of money to develop credits and that responds to the actuation of selection switches to initiate vending operations, and which comprises conductors extending from said data acquisition unit to said vending machine to receive serial bit streams containing digital logic data representing vending operations initiated by the closing of said selection switches and also containing further digital logic data representing the prices of products vended during said vending operations, a memory having locations in which running counts of the number of vending operations initiated by the closings of said selection switches can be stored, said memory having a further location in which a running count of the prices of the products vended during said vending operations can be stored, data processing means responsive to said serial bit streams to sense said digital logic data therein and to identify the selection switches that initiated said vending operations and to address the corresponding memory locations and to increment said running counts of the numbers of vending operations initiated by said selection switches, said data processing means also addressing the memory location wherein said running count of the prices of the products vended during said vending operations is stored to update said running count, said memory having another location wherein a number, which corresponds to the highest-number selection switch that has been actuated, is stored, wherein said data processing means compares the number of each actuated selection switch with said number in said other memory location and then re-writes the number which is in said other memory location in the event the number of the last actuated selection switch is larger than said number in said other memory location, whereby said number in said other memory location always represents the number of the highest-number selection switch that has been actuated.

21. A data acquisition unit as claimed in claim **20** wherein a data accepting unit which can accept data from said data acquisition unit is connectable to said data acquisition unit, wherein said data-accepting unit can provide a print out, and wherein said print out will not include entires for any selection switches that have numbers higher than the number of the highest-number selection switch that has been actuated.

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